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METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS

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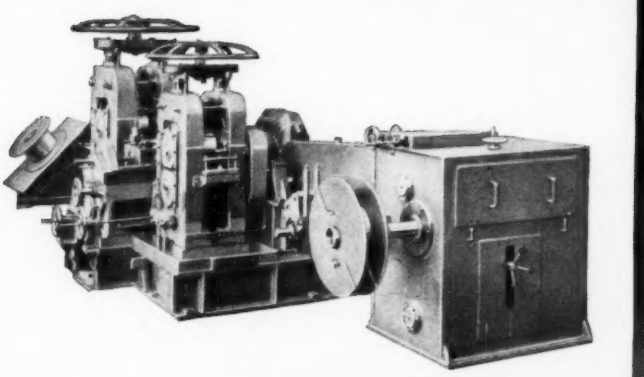

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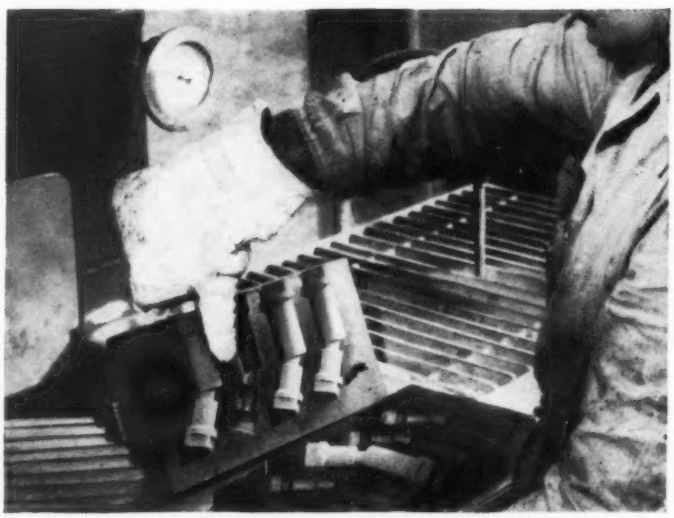

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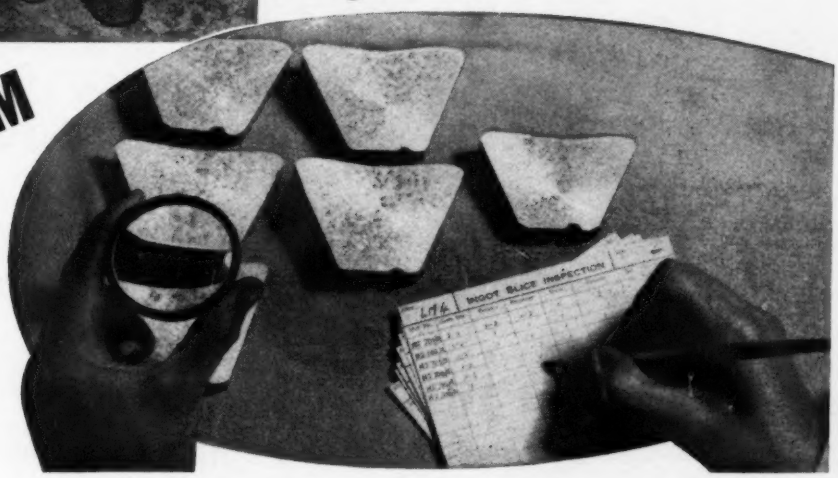

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METAL INDUSTRY

VOLUME 94 NUMBER 14 3 APRIL 1959

Protection and Packaging

A SOMEWHAT unusual subject for METAL INDUSTRY, in the form of a discussion on the economic protection and packaging of non-ferrous metals in storage and transit, commences in this issue. The discussion, which will be fully reported in subsequent issues, was organized last February in Birmingham by the Institute of Metals, and the number attending left no doubt that the subject is one of paramount importance to the non-ferrous metal industry as a whole.

The prime object of packaging is to ensure that the product arrives at the customer's works in the same condition as when passed by the producer's inspector. Packaging must be considered simultaneously with handling methods, means of transport and storage facilities, and with particular regard to the facilities available at the customer's plant. The main aim must be to move the material between producer and user at an economical cost. While, however, cost must be an important factor, every care should be taken to see that it never becomes the first consideration because if it does the standard of packaging is almost bound to suffer. Efficient and safe packaging is a combination of a number of factors. In the first place, only reputable packaging materials, preferably bought to specification, should be used. Secondly, only cases of sound design with efficient wedging should be employed. Good workmanship is essential, and a careful analysis of all complaints should be made so that faults and weaknesses may be remedied. Finally, commonsense must be applied to all the principles involved.

The basic causes of damage to packages may be enumerated as:—the use of incorrect packaging materials; inadequate protective treatment; handling during transit; and conditions of storage. The most economic packaging is that which ensures the goods arriving safely at their destination. If the pack arrives undamaged but the goods inside are damaged then the packing is unsatisfactory. If the goods arrive safely but the case is damaged, then the packing principles are sound but the materials used for packing are faulty. If both goods and package are damaged, then the design of the package is at fault. It is essential that the packing manager should be familiar with the use to which the product is to be put, so that special precautions may be taken where necessary. As an instance of this may be cited the case of Inconel strip required for automatic argon-arc welded tube. This strip must have undamaged edges, but if wrapped in crepe or other paper for protection, as was originally done, the slightest chafing in transit leaves paper dust on the strip sufficient to produce a flash in the welding process and thus spoil the weld.

For some products it is only necessary to guard against physical damage in transit and storage; for others it is essential to protect them against moisture. In this connection, apart from the risk of direct wetting by exposure to the atmosphere, the main bugbear is condensation, particularly in regard to products to be exported. In this connection it is of interest to note that vapour phase inhibitors have been found to be unreliable with aluminium; in certain circumstances, cases have been known of accelerated corrosion arising from their use.

With all the difficulties that can arise due to improper packaging, and particularly in loss of goodwill, it is obvious, as one contributor emphasized, that in every firm packing methods may well justify careful study for each order by someone who knows the hazards to which the product is exposed, the packaging materials available, the transport services to be used and who, above all, is "cost conscious."

Out of the MELTING POT

Variant

ONCE the principle of refining by zone melting had been discovered, numerous practical variations on the principle were not long in arriving. A number of these variations were concerned with converting what started as a reciprocating batch process into a straight-through continuous process. Although such truly continuous processes have been devised, those used in practice appear to be still of the discontinuous or semi-continuous type. Among the latter may be included processes in which the ingots of the metal to be subjected to zone melting are carried through a circular furnace. A furnace of this type has been developed in Russia and has been described with special reference to the zone melting of cadmium and other low-melting point metals. This furnace comprises a ring-shaped "merry-go-round," of about 2·5 m. diameter, formed from a hollow steel channel packed with loose refractory material for heat insulating purposes. The inwardly sloping bottom face of this furnace ring rests on a number of truncated cone-shaped rollers which enable the ring to be rotated in a horizontal plane by a suitable drive. Rollers bearing on the outer face of the channel serve to keep the ring in position. The upper surface of the ring carries seven sets of three concentrically-curved moulds in which the metal is refined. Both the inner and outer upper edges of the channel forming the furnace ring are provided with open channels, which are filled with a liquid having a flash point above 200°C. Into the liquid in these channels dip the bottom edges of a circular, inverted channel-shaped stainless steel furnace chamber. An air-tight seal is thereby formed between the furnace ring and the furnace chamber which enables the latter to remain stationary while the former rotates. An inert gas is circulated through the furnace chamber. As the moulds with the metal are carried round on the furnace ring, they pass under a series of eighteen silicon-carbide rod heating elements, which are mounted radially in the furnace chamber and are uniformly spaced around the circumference. They are provided with reflectors which direct the heat downwards to form the molten zones in the ingots. The ingots make one complete circular journey through the furnace during which journey, therefore, eighteen molten zones pass through each one of them at a speed of from 20 to 50 mm/hr., the complete once-round journey taking 136 to 342 hr.

No Interest

IF the truth were known, a large proportion of the complaints about the excessive amount of reading matter would be found to be caused not so much directly by this undoubted fact but indirectly by the style in which practically all of it is nowadays couched. Not that there is anything actually wrong with the style. Indeed, a remarkable feature of this increasingly mechanized, electronized, and otherwise -ized age is the widespread concern about style. With the amount of care consequently taken over this matter of style, the result can hardly be criticized for being what it is. There was a time when the statement: *le style c'est l'homme* still applied, or, more correctly, was still felt to apply. As a result, the styles, such as they were, of technical and scientific writings were those of their authors, and the perusal of such reading matter was still something in the nature of a personal communication, with the consequent possibility of a personal interest. However grammatically correct and otherwise impeccable the style of present-day scientific and technical writing may be, it is at the same time impersonal. As such, it cannot possibly give rise to the feeling of personal communication, and the reader is given no chance of developing any personal interest in connection with his reading. Reading is thus reduced to a process of absorbing information. No wonder that, in the circumstances, so much interest is being taken in ways and means of speeding up or cutting out as much of the process as possible, and no wonder there are all the complaints about not being able to get through one's reading fast enough.

Usable

EXOTIC fuels, it appears, are not to remain restricted to rocket propulsion, for the use of. Evidence in support of this view is provided by some recent experiments with the hydrogen-nitrogen trifluoride torch. In this torch, ammonia and natural gas can be used in place of hydrogen. In these combinations, the nitrogen trifluoride acts as an oxidizing agent, the fuel gas burning quietly with it. The heat of reaction for nitrogen trifluoride with hydrogen is relatively large (110 kcal as compared with 58 kcal for the hydrogen-oxygen reaction), and the flame temperature is correspondingly high. In the experiments, the torch consisted of two concentric tubes, an inner tube of copper with a 0·037 in. inside diameter and 0·094 in. outside diameter for the nitrogen trifluoride, and a 0·188 in. inside diameter and 0·250 in. outside diameter nickel outer tube for the hydrogen. The gas flow was controlled with brass needle valves, and the torch was normally operated with flow rates of 1·5 and 0·4 L/min. of hydrogen and nitrogen trifluoride respectively. There is no ignition when the two gases are mixed, and a premixing type of torch could, therefore, be used. From the point of view of metal fabrication, the main interest of the hydrogen-nitrogen trifluoride torch is the self-fluxing action of the flame due to the presence of fluorine, which forms fluorides with metals when these are heated by the flame in welding, brazing and cutting operations. Some exploratory tests showed that this enables the welding of such "awkward" combinations as Chromel-Alumel, iron-Constantan, copper-Constantan, Kanthal A-Kanthal A, and Stellite No. 6-Stellite No. 6, the silver soldering of nickel and stainless steel, and the brazing of such combinations as brass on molybdenum, Nichrome on tungsten, Nichrome on graphite, nickel on molybdenum, and ferro-silicon on graphite. Nitrogen trifluoride was prepared by electrolyzing molten ammonium bifluoride and condensing and fractionating the anode gases. Contrary to expectations, nitrogen trifluoride is a relatively stable gas at room temperature. It can be stored under pressure in steel cylinders, and satisfactorily handled using valves, hoses, etc., recommended for handling oxygen. Apart from the availability, and cost, of the nitrogen trifluoride, a drawback of the hydrogen-nitrogen trifluoride torch is the formation of hydrogen-fluoride as a product of the combustion, and the consequent need for suitable safety precautions.

Skimmer

INFORMAL DISCUSSION ORGANIZED BY THE INSTITUTE OF METALS

Protection and Packaging of Non-Ferrous Metals

ORGANIZED by the Institute of Metals, an informal discussion on "The Economic Protection and Packaging of Non-Ferrous Metals in Storage and Transit", was held at the College of Technology, Birmingham, recently. Professor H. Ford, D.Sc., Ph.D., D.I.C., WH.Sc., M.I.Mech.E., occupied the Chair.

Representatives from the non-ferrous metal manufacturers and fabricators, user industries, various Government departments and interested technical associations, packaging material manufacturers, wrapping machine manufacturers and transport and insurance organizations and companies formed a large and appreciative audience.

Two opening addresses were given, the first by Mr. L. J. Soper of the Northern Aluminium Co., Ltd., Rogerstone, who dealt with the light metals, followed by Mr. H. Baskerville, Distribution Manager of Imperial Chemical Industries, Limited, Metals Division, who covered the subject from the point of view of copper and copper alloys.

DISCUSSION

L. J. Soper (Northern Aluminium Co. Ltd.):

In the range of materials at the packer's disposal there are wood, a variety of papers for case linings and interleaving (these include kraft union, crepe waterproof, waxed kraft, tissues and foil laminated papers, to mention just a few). In addition, there is reinforced cardboard, hardboard, polythenes, aluminium foil, etc. The materials most commonly used are, however, wood and paper. Wood is favoured because it gives good protection against mechanical damage and also provides a strong, rigid pack; it is also capable of being used for quite a number of journeys before it finally becomes an expendable item.

Experience has shown that most problems arise on sheet products. This is due to the very large surface areas relative to the volume, and because these areas are in intimate contact when the sheets are lying in the case. This can result in moisture condensed either inside the pack or in stores penetrating by capillary action in between the sheets and causing corrosion. Another hazard is, of course, traffic marks or "fretting," as it is sometimes called, which can occur through any undue movement of the sheets inside the pack during transit.

Packing should be carried out in a building where wide variations in temperature are not likely to occur, and these remarks apply also to storage.

Aluminium Sheet

Flat sheet is usually packed in cases or on skids, the metal being protected from moisture by lining the container with a layer of waterproof kraft union and an inner lining of pure kraft or, alternatively, waxed kraft, dependent on the journey. Waxed kraft is a good water repellent and is advisable if the metal is likely to be in transit for any considerable time.

Both these packs should be pressure type; this means that the lid is placed firmly on top of the sheets and held securely to the base by tensional steel strapping. When packing long sheets it is advisable to place the strapping both in the longitudinal and transverse directions to give extra rigidity. To enable the case to be pressure packed, the lid must be made slightly smaller than the inside dimensions of the base and the sheets stacked sufficiently high to allow the lid to remain "proud," thus enabling the tension to be correctly applied. This form of packing provides good protection against traffic marking.

Generally speaking, it is not considered necessary to apply protective oil to pure aluminium and to the non-heat-treatable alloys, as in most cases this material invariably has a residual film of oil left on it after rolling. However, sheet for the aircraft industry, which is generally in the stronger alloys and which is more susceptible to corrosion, should be treated

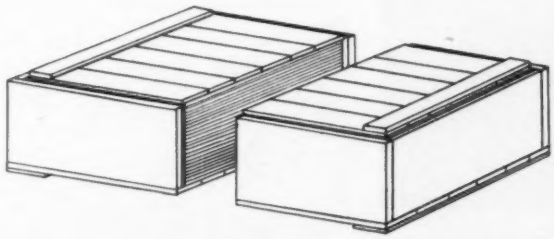
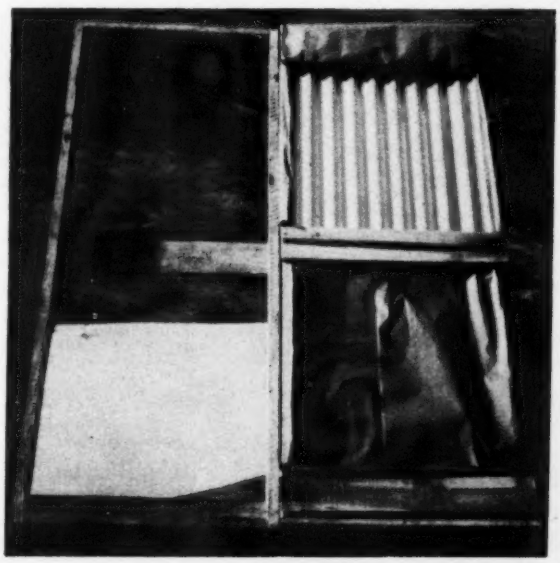


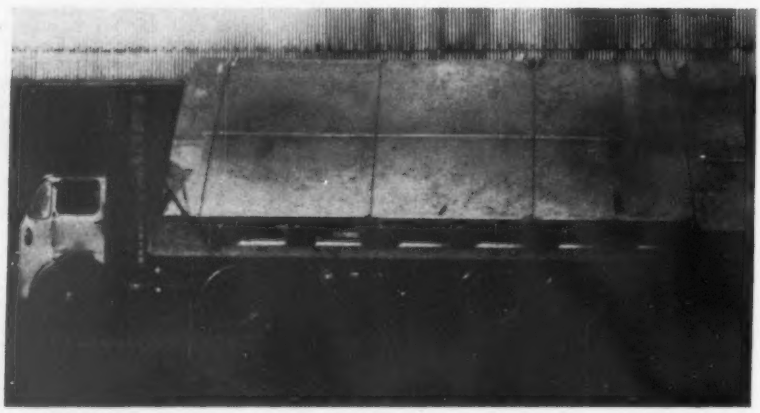
Diagram of a pressure packed case, sectioned to indicate the method of stacking the sheets, which are slightly higher than the sides of the case but will be pressed down when the lid is held in position by the tensional steel strapping



Left: An export crate for shipping circular corrugated sheet. The paper has been partly removed to show the contents. When packing sheet such as Mansard, Snaprib and Industrial patterns, the crates should be reinforced top and bottom with hardboard for extra protection

Right: Method of packing heavy coils in paper and plywood. The coil is completely wrapped with kraft union and waterproof kraft union and then enclosed with plywood. Wooden discs are then added and the whole package is securely held together with tensional steel strapping. The coil is held in position by wooden plugs attached to the top and bottom discs

A coil of foil stock in the fully annealed (soft) condition illustrating the three stages of packing prior to placing the coil into the case. Stage 1, left, shows a wooden plug inserted into the bore to prevent the build-up collapsing, and the plug is covered with mouldable wrap, as a barrier against moisture. Stage 2, centre, shows an aluminium disc which has been placed on the build up of the coil for protection, and Stage 3, right, illustrates the finished pack. This form of coil packing has been used very successfully and is a good insurance against corrosion and condensation



A load of large welded plates for the shipbuilding industry. These plates are sometimes over 12 ft. wide and over 24 ft. long. They are loaded, and secured with heavy duty steel strapping to prevent movement in transit

with protective oil to one of the approved specifications, and the sheets should be tissue interleaved. It is sometimes necessary, dependent on destination and end use, to interleave certain sheet for the commercial market, but this is not general practice. It should be mentioned that even if the interleaving paper is neutral—that is, neither alkaline nor acid —and is free from sulphates and chloride, it is advisable to remove it as soon as possible as the packing may still absorb moisture from the air, particularly if the storage conditions are suspect.

Corrugated sheet, due to its rigidity, can be safely despatched to the home market in bundles, and for destinations overseas a skeleton case (or crate) lined with waterproof kraft union will generally suffice.

The wider variety of sheet in coil form for general engineering purposes can be banded with steel strapping and despatched loose, excepting for the export trade, when it requires some protection against mechanical damage. A very good method, and one which saves a considerable amount of shipping space and tare weight, is to wrap the outside of the coil with waterproof paper and plywood, and to protect the two ends of the build-up with wooden discs, the bottom one being fitted with runners to facilitate lifting by fork truck.

When shipping materials to destinations where severe fluctuations in temperature are likely to be encountered—for example, Indian and South American markets—extra care is needed to guard against the effects of condensation. Aluminium foil or mouldable wrap—the latter being a form of cheese cloth impregnated with wax—are both suitable for this type of order and give good results.

Plate packing presents comparatively few difficulties. Shipbuilding plate may be despatched loose on a lorry and only requires strapping to prevent excess movement during transit.

Plate for aircraft and other specific applications is usually packed on skids, the surfaces being oiled and tissue interleaved where necessary.

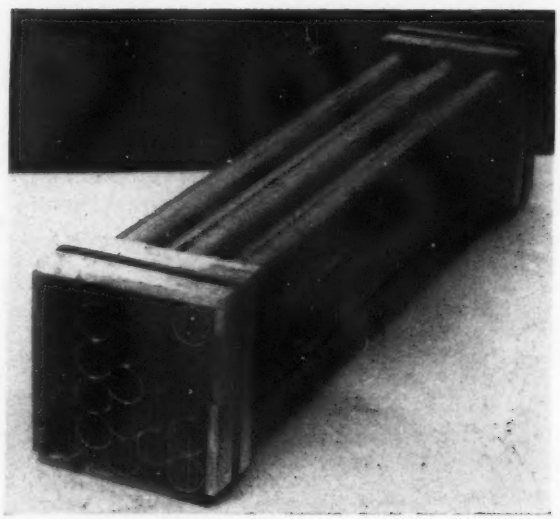
All case and skid linings should be sealed with some form of adhesive tape.

One final word on case and skid packing: an enormous saving can be effected whenever it is possible to pack large amounts in one container. As an example, the cost of timber used to construct a case of 500 lb. capacity works out at 1·2d/lb., for 1,000 lb., 0·63d/lb., and for 2,000 lb., the figure is 0·34d/lb. Unfortunately, it is not always possible to achieve this economy owing to weight limitations imposed by customers due to lifting and handling facilities.

Aluminium Sections

Extruded and rolled products do not present quite the same difficulties as sheet; and rod, bar, channel, angle, Tee-sections and the like, for general engineering purposes, constructional use and for shipbuilding can be shipped in bundles held together by steel strapping.

Sections for the aircraft industry which are to be machined also lend themselves to this form of packing. It is an advantage to place the strapping over wooden battens, which not only prevent the straps from damaging the metal but keep the bundle in shape. Additionally, it facilitates lifting with rope slings or fork lift trucks.



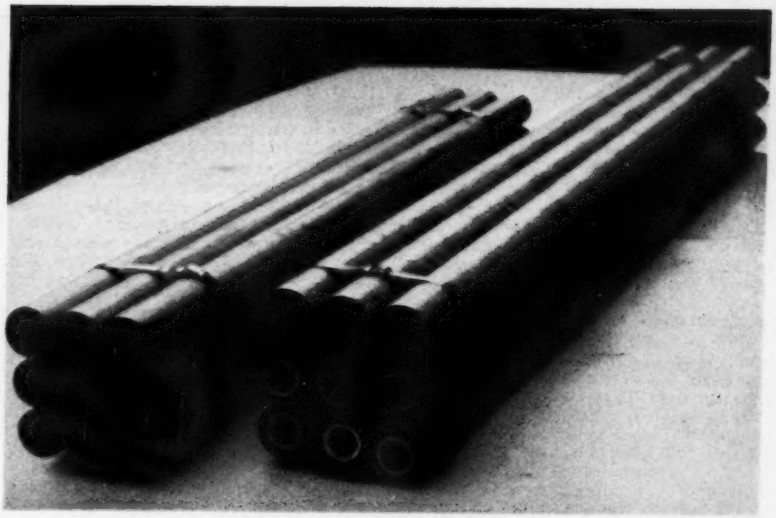
Method of bundling extruded sections. This form of packing is quite suitable for destinations within the domestic market

Thinner and more fragile shapes, material on which finish is of particular importance, thin-walled tube and metal in the fully softened condition, obviously call for better protection, and this class of work should be packed in a case or crate, as also should sections for export. Fully softened material, and that which will ultimately be polished or anodized, should be interleaved to prevent chafing. Aircraft sections, whether bundled or cased, should be oil protected. Containers are lined with paper as for sheet packing.

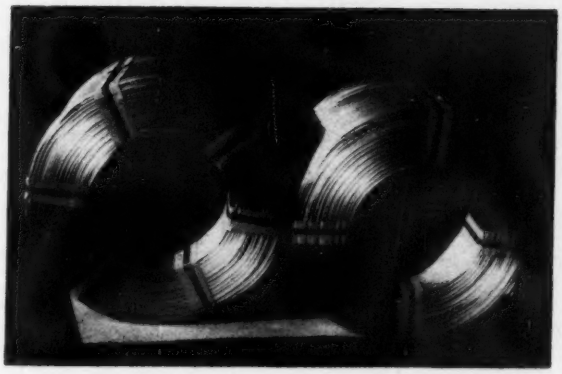
Small quantities of section which are unsuitable for bundling and yet are too small to permit an economical case pack can quite safely be wrapped with crepe paper on an automatic wrapping machine, with longitudinal boards incorporated to prevent distortion.

Certain tubes, such as irrigation tubes, which are usually ordered in various diameters but in the same lengths, should be nested one inside the other, taking care to separate each tube to prevent damage. This form of pack gives a considerable saving in cost and is most economical when shipping overseas, due to the saving in space.

Rolled rod stock is invariably despatched loose both to the home and export markets and, wherever possible, is supplied in large "jumbo" coils. These jumbo coils are made up of several smaller coils which are butt welded together until a weight of, say, 2,000 lb. is obtained. The coils are securely strapped to prevent the layers collapsing and are then ready for despatch. Should a customer request extra protection a good method is to wrap the coils with crepe waterproof paper or corrugated cardboard.



Above: Illustrating the advantages to be gained by nesting tubes. It will be observed that although the packs are more or less the same size there are three times as many tubes in the nested pack



Right : Jumbo coils made up of smaller coils butt - welded together and securely strapped

Mechanical Aids

From the economic standpoint, it is very necessary to take advantage of mechanical aids where they can be proved to be beneficial. One such aid in a case-making shop is a nailing machine, of which there are two types: (a) the large machine, which is a permanent fixture and which is capable of driving home quite a number of nails in one operation; and (b) the small portable machine, which drives nails singly and is operated off a compressed air line. The portable machine is extremely suitable for nailing all sizes and types of cases in whichever order they may be presented, and does not rely for its efficiency on a fairly long run of one specific size. Two of these machines—one for making the units and the other for assembling—working side by side make a very efficient set-up.

Wrapping machines are also faster and more efficient for packing materials in bundles and coil forms, and should be used whenever possible. There are also automatic banding machines on the market, but these appear to be more suited to those industries handling a more or less standard pack. In the non-ferrous industry, the size and shape of containers vary considerably.

Another excellent way of reducing costs is by combining packing with another operation, the most obvious one being inspection. All sheet should be inspected and packed in one operation whenever this is practicable. Apart from being a much cheaper method, it also has the added advantage of eliminating the risk of damage which can occur if metal is inspected and then left lying around awaiting packing. Wherever possible, extrusions should also be handled in this manner, and certain types of jobs can be inspected off the extrusion press and packed on the spot.

Finally, regarding non-returnable cases —a subject very much in mind at the present time—it would be interesting to hear of the many experiments that have been tried and the new materials used.

Mr. H. Baskerville (I.C.I., Metals Division):

In the non-ferrous metal industry, which is primarily supplying raw materials to other manufacturers in semi-fabricated form, the prime object of a package is to ensure that the product arrives at the customer's workplace in the same condition as it was in when passed by the producer's inspector. The appearance of the package is of very much less importance than is the case in distributive trades dealing with consumer goods, where the package is frequently a major sales aid. There are some industries in which the package performs a function in the process of manufacture, for example, in the wine trade both the casks and bottles play a part in the maturing process, but in the non-ferrous metal trade a package always costs and rarely earns.

Packaging cannot be considered in isolation. It must be considered simultaneously with handling methods and methods of transport, storage facilities, etc. One type of package can be perfectly satisfactory if loaded on to a vehicle for through transit to a customer's premises, where both customer and producer have comparable lifting equipment. The same product might require quite different packaging if it were going to be trans-shipped from the vehicle whilst in transit, or if the customer's handling equipment were quite different from the producer's. For example, the producer might use fork lift truck and the customer slings. This would necessitate the use of packages suitable for slinging.

The title of this conference emphasizes the economics of packaging, and unless a package is economically acceptable its technical excellence is of no practical interest. The aim is to move the goods between producer and user at the lowest possible cost without taking undue risk about the quality of the product which the customer receives, and the qualification about quality is primarily of importance because of the value of goodwill which will be lost if customers receive goods damaged in transit because of bad packaging.

In order to achieve the object of moving the goods between producer and user at the lowest possible cost, the following factors must be taken into account simultaneously:

(a) The cost of packaging materials; (b) the labour cost in packing; (c) the handling costs of the packed product; (d) transport costs; and (e) if packages are returnable, the administrative costs involved in getting packages returned, and the cost of repairs.

By considering these heads simultaneously, an increase in any one is acceptable if it is accompanied by a greater reduction in the cost of any other or others. For example, an increase in transport charges to ensure through transit from point to point might be justified if, by arranging such transits, the additional cost of the transport is more than recovered by a reduction in packaging costs.

In its simplest form, packaging is designed to give protection from physical damage, and there are some products where this is the only protection that is required. For example, when dealing with titanium, hazards from moisture or other contamination are slight, and in such instances all that is required in the package is sufficient support to prevent the product from being damaged by slings, etc., when being loaded on to, or removed from, a vehicle. Good package design will, therefore, provide the necessary protection using the minimum quantity of packaging material, making use wherever possible of the strength in the product itself.

Copper Base Alloys

In dealing with copper and copper-base metals, one of the most common hazards to which goods are exposed whilst in transit or storage is moisture. This may arise from two sources, either direct wettage by exposure to rain, sea water, etc., or condensation. Steps can be taken to minimize the danger of wetting from exposure to water, superficial protection being provided by the usual softwood case with tarred kraft paper linings, etc., or a better degree of protection can be given by using "Alkathene" linings for cases, the "Alkathene" joints being sealed. The problem of condensation is much more difficult to deal with, and is more complex. Condensation arises when the temperature of the product is below the dewpoint of the atmosphere in which it is placed. This is most frequently encountered in the holds of ships, but may also be encountered in storage warehouses, etc. To minimize the effects it is necessary to pay very close attention to ventilation of the vessel or warehouse.

It is quite easy to see that if a vessel is loaded with a cargo of metal in Northern latitudes for a journey through the Tropics, the cargo may very well be considerably cooler than the air temperature when it arrives in tropical latitudes, and it is necessary that the ventilation of the ship's hold shall be undertaken very carefully, as merely to increase ventilation would increase the condensation and, therefore, the wetting of the cargo. Similarly, if products are being packed in a fairly warm atmosphere, care should be taken to reduce to a minimum the amount of air in which the product is standing, as the temperature of the surrounding air in the outer package may fall below the dewpoint when the package is in transit. It may, for example, be worth while to wrap coils individually rather than to leave the air through the core of the coil in contact with the metal. For anyone wishing to gain more technical information on this subject there is a useful pamphlet, "The Principle of Condensation," published by the Research Committee on Marine Moisture Damage of the Association of Marine Underwriters of British Columbia. Reference is also made to the subject in "Lloyds Survey Handbook." The danger of condensation applies to warehouses as well as to ships, and careful instructions should be given to warehouse staff about ventilation, but, from a packaging point of view, it would appear that the best protection is to minimize the volume of air inside the package, or, in other words, to reduce the space in which the product is enclosed to a minimum, preferably with an airproof barrier.

Another source of moisture is the softwood package so commonly used in the non-ferrous metal industry. It is essential that softwood packages should be thoroughly dried before being used, and this question of dryness is possibly not sufficiently understood. An experiment has recently been conducted of submerging a softwood case in water until it was thoroughly soaked. It was left to dry in an open shed and during the first ten days it lost 12 lb. in weight, and at that stage was adjudged by an operative to be fit for use. The case was transferred to a heated building with a temperature of approximately 65°F., and in the following three days lost a further 14 lb. in weight, and eventually the weight became static 16 lb. below the point at which it was originally considered to be dry enough for use. To complete the experiment, the case was taken back into the open shed, and in three days it gained 3 lb. by absorption of moisture from the atmosphere. It is obvious that if a case dried in normal winter temperatures were used for packing coils of strip, and then placed in a fairly warm warehouse or other building, the air inside the case would take up moisture from the timber and ultimately deposit it on the product with suitable changes of temperature.

This difficulty of the moisture content of softwood cases can be overcome by various measures, for example, certain Government package specifications call for a complete lining with tin plate, the lining being sealed to make it airtight. The cost of this type of package is such that it could not normally be used for commercial purposes, but recent experiments lead to the belief that comparable protection can be provided at lower cost by substituting plastics film for tin plate.

Experiments have been conducted using "Alkathene" film for lining softwood cases, with varying results To be effective, the film must be heavy enough to withstand the physical action of the product on it, and there is frequently a tendency for brass sheets, for example, to cut the film. Nevertheless, improvements in preventing the effect of moisture have been achieved by using quite thin "Alkathene" films instead of paper. It is necessary to seal the joints in the "Alkathene" film.

A fair measure of protection from moisture can be gained by lining cases with tarred kraft paper and being careful how the edges are folded in, and even plain kraft paper is of some value in this regard. Most papers contain small quantities of compounds containing sulphur or chlorine, and if the amounts of such constituents are high, particularly with respect to sulphur compounds, staining will increase. There are on the market a number of papers with a fairly low content of injurious chemicals.

Another method of reducing the effects of moisture is to use chemical inhibitors such as silica gel, etc. These present little difficulty if one is dealing with coils of strip where the inhibitor can be placed in the centre of the coils, but it is not physically easy to use inhibitors where the material packs solidly into the package, for example, sheets. They are, however, somewhat expensive, and may frequently be disregarded on economic grounds.

For many purposes there are advantages in using alternatives for the softwood case, and a certain amount of success has been achieved by using plywood kegs for strip in coil. They have several advantages in that they are much lighter and far more proof against moisture than the traditional softwood case, but they present certain difficulties from the point of view of handling.

User's Convenience

Although "eye appeal" is not of paramount importance in the packaging of non-ferrous metals, there are instances in which careful thought to the design of the package can be of considerable assistance and value to the customer. For instance, a paper tube used for packing welding rods has a label of a distinctive colour on the outside, and also an end which can be completely removed, leaving almost the whole length of the tube still available for use in storage. The colour scheme of the label indicates the alloy, and is repeated on the painted ends of the rods. The advantage is that the risk of alloy mixing is minimized.

Another way in which the user's convenience may be considered is exemplified in a drum used for carrying raw titanium from the plant which produces it to the plant which melts it. The drum was specially designed to mate with the feeding gear on the melting furnace, the object being to minimize the amount of air which could get into the furnace when accepting the charge. In any event, it would have been necessary to design a vessel suitable for charging the furnace and, by combining this with the package, double handling of the material was avoided.

In considering the economics of packaging, two major factors should not be overlooked, viz. weight and volume. Carriage charges are normally paid on the gross weight carried, and these can be materially reduced by using light packaging materials. This can often be achieved in the non-ferrous metal trade by making some use of the strength in the product itself. It may be possible to use lighter timber in a case which is to carry 12-gauge sheet than would be necessary in a case used for 24-gauge sheet, the rigidity of the 12-gauge sheet providing part of the necessary strength. Volume may be important in the export field, because in certain circumstances freight charges are based on volume instead of weight. For example, in shipping light gauge large bore tubes, freight would probably be charged on volume, so that the dimensions of cases should be minimized. Frequently it is impossible to do anything about this, but sometimes steps can be taken, for example, the nesting of various sizes of tubes. The aim should be to keep the volume below 40 ft^3/ton.

Modern handling methods are increasing the number of opportunities to dispense with packing cases in favour of pallets, which may even be constructed of light, cheap materials.

Finally, packaging methods may well justify careful study for each order by someone who knows the hazards to which the product is exposed, the packaging materials available, the transport services which may be used and, above all, is "cost conscious."

(To be continued)

AN OUTLINE OF CURRENT METHODS FOR PRECISE DETERMINATIONS

Analysis of Zirconium and Zirconium Alloys

By W. T. ELWELL, F.R.I.C.

(*Concluded from* METAL INDUSTRY, 27 *March* 1959)

DETERMINATIONS of *cadmium* and *lead* are similar in so far as both separations from zirconium are based on reactions with dithizone, and both determinations are completed polarographically; it is essential to have a sensitive instrument, e.g. incorporating a cathode ray.

As in conventional polarography, the basic principle of the cathode ray polarograph consists in applying a steady rise in potential to an electrolytic cell containing the sample solution and a dropping mercury cathode, measuring the current passing through the cell, and plotting this against the applied potential. The resulting polarogram has a step-like form, the position and height of which, subject to certain limitations and precautions, is determined by the nature and concentration of reducible ions in solution.

In conventional polarography, the potential sweep is spread over many drops of mercury from the cathode, and the mean current is recorded either photographically or by means of a pen recorder. In cathode ray polarography, the complete potential sweep is repeated once in the lifetime of each mercury drop and the instantaneous current is observed on a cathode ray tube. This form of polarography has very definite advantages in speed, sensitivity and resolving power, and is particularly suitable for determining metals at the p.p.m. level.

Dithizone reacts with most metallic ions, but the reagent can be made selective by modifying the aqueous (as distinct from organic) conditions, typified by these two determinations. The metallic complexes, or dithizonates, are soluble in chloroform, and it is usual to add a chloroformic solution of the reagent to an aqueous solution of the sample, then recover the immiscible organic phase for further treatment. Shaking the chloroformic extract with strong mineral acid serves to transfer metallic ions to a second aqueous phase; alternatively, it may be more expedient to recover the metal by simple evaporation (and calcination) of the organic layer. Once the metal has been isolated in either of these ways, the criterion for application of the polarographic procedure is that the half-wave (reducible) potential of its ions, in the recommended base solution, should be adequately separated from those of any other "foreign" elements surviving the extraction processes.

In an ammoniacal citrate solution, dithizone isolates cadmium from most metals which would otherwise interfere, and extraction of the separated organic phase, with a strongly ammoniacal tartrate solution, serves to remove the small amount of lead invariably extracted with the cadmium.

From a solution of the sample, adjusted to a *p*H of 9-9·5, in the presence of ammonium citrate and hydroxylamine hydrochloride, lead and bismuth are extracted with dithizone, and reaction of these separated dithizonates, with an aqueous buffer solution (*p*H 3·4), returns lead quantitatively to this aqueous phase for the subsequent polarographic determination. Alternatively, to this aqueous extract may be added an ammonium cyanide solution, and lead may be re-extracted with dithizone and determined, in the organic phase, by a direct optical density measurement, but this procedure is less precise than the polarographic procedure.

In all polarographic and absorptiometric procedures it is most essential to provide reliable calibration graphs, and these must always be prepared in strict accordance with the appropriate procedures; blank determinations are of equal importance.

Colorimetric Procedures

The practice of determining the concentration of a substance in solution by comparing its colour with that of a solution containing a known amount of the same substance is one of the oldest branches of analytical chemistry. The use of "Purple of Cassius" (tin and gold chlorides) for determining gold has been known for a very long time, and Nessler's reagent for determining ammonia has been well established for over a century. There is, however, little doubt that many early colorimetric methods led to estimations rather than determinations.

Over the past thirty years there have been rapid advances in the development of more selective and specific reagents for use in colorimetric analysis and, particularly since the outbreak of World War II, improved designs in instruments for determining optical densities of coloured (and uncoloured) solutions, usually in the region of maximum absorption, have resulted in the adjectives "colorimetric" and "absorptiometric" being almost synonymous. Of choice, direct colorimetric procedures are, obviously, preferred.

Chromium, cobalt, iron, tungsten, phosphorus and *copper* are elements determined colorimetrically by procedures based on initial solution of the weighed sample in one of several mineral acids, with or without the addition of fluoboric acid.

Chromium is determined by direct evaluation of the colour produced when diphenyl carbazide reacts with chromate ions; chromium in the sample is oxidized to the higher valency by ammonium persulphate, catalyzed by silver nitrate.

The direct determination of cobalt is based on the formation of an orange-coloured complex when cobaltic ions react with nitroso-R-salt, in a buffered (*p*H 6) solution.

Thioglycollic acid is an extremely good reagent for determining iron; it reduces this metal to its lower valency, then reacts to form ferrous thioglycollate, which is characteristically coloured, and iron in zirconium is determined in this way.

Very small amounts of tungsten are determined following reaction of tungsten, in solution, with toluene-3:4-dithiol and extraction of the coloured complex with iso-amyl acetate.

The determination of phosphorus is based on the formation of orthophosphoric acid, conversion to phosphovanadomolybdic acid, and extraction of this coloured compound with a mixture of iso-amyl alcohol and ether.[9]

Copper is determined by means of sodium diethyldithiocarbamate. The copper complex is extracted with chloroform, then determined absorptiometrically.

The time taken to complete each of these determinations varies, and an average time of about 2 hr. should be allowed.

Volumetric Procedures

Tin is the only element determined volumetrically. A relatively large sample weight is dissolved in the fluoboric/hydrochloric acid solvent, and tin is reduced to its lower valency by added aluminium. Quantitative reduction is assisted by the presence of added titanium, and the determination is completed iodometrically, by titration with standard potassium iodate solution.

Carbon

The procedure for determining carbon is based on oxidation of the weighed sample in a mixture of argon and oxygen; argon is present to

prevent the reaction from proceeding violently.[10]

The apparatus used in this determination is essentially the same as that used for determining carbon in metallurgical materials, such as iron and steel. Special consideration must, however, be given to the type of flux used and the method by which the evolved carbon dioxide is evaluated.

A good flux is provided by adding 2 gm. of chemically pure lead and 1 gm. of high purity iron to 1 gm. of the finely prepared sample.

After the gaseous products of high temperature oxidation have been evolved, there are at least three methods of determining the amount of carbon dioxide present. It can be (a) absorbed and weighed in solid alkali—there are several proprietary brands available and these usually include an "indicator"; (b) calculated from the change in conductivity of a dilute solution of sodium hydroxide following absorption of the gas; and (c) solidified in liquid oxygen, gasified into a previously evacuated calibrated system and calculated from the change in internal pressure.

The latter, "low pressure," procedure is recommended for routine control purposes because it is rapid; a result can be obtained in about 10 min., but where a higher order of accuracy is required, the conductometric procedure[11], which takes about an hour to complete, is preferred.

Boron

To determine boron below the 0·5 p.p.m. level demands special attention to detail, and conditions of cleanliness approaching those of surgery are essential. Boron compounds are common constituents of everyday commodities, and traces of the element are present even in high grade analytical reagents. The first essential, therefore, is to provide an isolated room and ensure that every effort is made to exclude this element.

The determination of boron is based on a preliminary solution of the sample in a mixture of hydrofluoric acid and methyl alcohol; this is done in quartz apparatus consisting essentially of a flask fitted with a condenser. Ammonia gas is used to neutralize excess acid, the solution is made slightly acidic with hydrochloric acid, anhydrous calcium chloride is added to take up excess water, and boron is distilled as methyl borate, using a methyl alcohol generator. Methyl borate is converted into a boron/curcumin condensation product, under very carefully controlled conditions. This compound is extracted with acetone, and an optical density determination of the coloured extract is used to evaluate the amount of boron present. A blank determination, using the same apparatus and the same amount of reagents as in the test is most essential, and the final stages of these two determinations must be done simultaneously. It is unusual for the boron content of the sample to be known in much less than a full working day.

Chlorine

An earlier method used for determining small amounts of chloride in these materials is based on the formation of colloidal silver chloride and comparison of the turbid solutions against a series of standards.

This method has one serious disadvantage. The preparation of reference standards, under very carefully controlled conditions, is imperative; the procedure is, therefore, subject to an unusual degree of personal skill and individual bias.

The determination of chloride is now made by a very simple, yet elegant, reliable procedure involving "amperometric" titration with a deci-normal solution of silver nitrate.[12] The end-point, described as "double dead-stop," is achieved by immersing a specially-prepared electrode, consisting of three wires—two silver (each coated with silver chloride), one platinum—into a fluoboric acid/sulphuric acid solution of the sample, and noting the changes in current during the course of the titration. Successive additions of the standard silver nitrate solution cause the sensitive galvanometer deflections to decrease to a minimum value (the end-point), then increase, producing a simple V-shaped titration curve when the two variables are plotted.

A single determination can be completed in about 45 min.

Conclusion

An attempt has been made to give the reader a condensed account of the analytical procedures in current use in the laboratories of the Metals Division of I.C.I. The procedures, all of which are under constant review with the idea of improving speed and accuracy, will serve to indicate the vast amount of effort devoted to the analytical control and maintenance of quality of these high grade materials.

"Behind the scenes" are the experience and skill of a team of qualified analysts, chemists and physicists, with assignments not confined solely to application of the procedures already outlined.

The analyst must provide the procedures in the first instance and be satisfied that they are reliable beyond all reasonable doubt — but that is another somewhat lengthy story. He must periodically prepare reliable calibration graphs, and ensure the continued validity of applied procedures when the metallurgist introduces, or changes, an alloying constituent. It is his constant concern to ensure that only analytical reagents of the highest quality are supplied and used, and he must keep a vigilant watch on all blank determinations, and reject any batch of reagent likely to contain, out of reasonable proportion, the element to be determined. Whenever possible, he must provide independent assays by alternative (invariably much longer) procedures; a remit that frequently promotes healthy competition between the chemist and the physicist.

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Correspondence

Correspondence is invited on all subjects of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents whose letters appear in these columns

TO THE EDITOR OF METAL INDUSTRY

Operational Factors in Die-Casting

SIR,—I was interested to read the translator's note on Russian die-casting alloys which followed the article by P. P. Moskvin in your issue for 13th March. I was recently a member of a team which visited Russia officially to study the zinc industry, and agree that zinc alloy die-casting is not much used except for motor car components.

However, the statement that the zinc resources of the U.S.S.R. are not great is quite wrong. The country is the second largest zinc producer in the world, and its output is expanding. In fact, as many of your readers will know, considerable quantities of surplus Russian zinc have been exported to Europe in recent years.

Yours, etc.,

A. R. L. Chivers.

Zinc Development Association,
34 Berkeley Square,
London, W.1.

Electrical Materials

A NEW publication has been issued describing the properties and uses of the various grades of nickel-chromium and nickel-chromium-iron alloys manufactured by Henry Wiggin and Company Limited. These include electrical resistance alloys for use up to a maximum operating temperature of 1,250°C. In addition to data on these alloys, sections are included on materials for leads and connections, furnace elements, thermocouples, etc.

Copies of the publication are obtainable free on request to the Publications Department, Henry Wiggin and Company Limited, 20 Albert Embankment, London, S.E.11.

A SURVEY OF THE HALLSWORTH AUTOMATIC MOULDING SYSTEM

Packaged Foundries

By H. B. HALLSWORTH, R. D. MILLS and PETER SPEAR

(*Concluded from* METAL INDUSTRY, 27 *March* 1959)

TO ensure efficient labour utilization and for inspection purposes, the completed mould is loaded manually into the rotary conveyor which is shown in Fig. 10. The operator effort needed is slight, since a slip is provided at the end of the coring conveyor down which the boxes slide into the next pallet. From this point, the mould is handled mechanically.

The mould clamping mechanisms or pallets, depicted in Fig. 11, are carried on the outer ring of the rotary track. Each unit consists of a base with a spring-loaded top, and is mounted in pivots about the bottom pallet between two specially designed upright supports. In each pair of pivot members, two links are fitted loosely, one each side of the mechanism, and connected together with a steel bar which projects a short distance through each link. This bar is provided with a pressure roller in the centre. A roller is fitted to the underside of the mechanism which engages with a cam rail controlling the angle of tilt. When the mechanism is tilted, clamping is effected by the projecting ends of the link tie bar interfering with the top of the two vertical supports, causing the pressure roller to force the top plate downwards on to the mould.

When the mechanism is restored to the horizontal position, again by the control of the roller engaging with the cam rail, the clamping pressure is relieved, which enables the springs to exert an upward thrust to the top plate and so facilitate the removal of the mould. The pallet mechanism is so designed that any unevenness of the sand face does not interfere with the ultimate contact of both box parts, and the mechanism is aligned essentially about the major pouring axis of the box. The clamping arrangements have been designed to resist any ferrostatic pressure likely to be encountered, and thus prevent any possibility of metal leakage.

Following the casting of the mould, the track continues to take the pallet round with no change in angle. During this period the cast metal is solidifying, and steps have been taken to ensure that no vibration occurs. The speed of the track has to be controlled to enable the casting to solidify completely, and this, in turn, controls the whole clamping, pouring and shake-out cycle. The track is wire rope driven from a variable speed gearbox and electric motor.

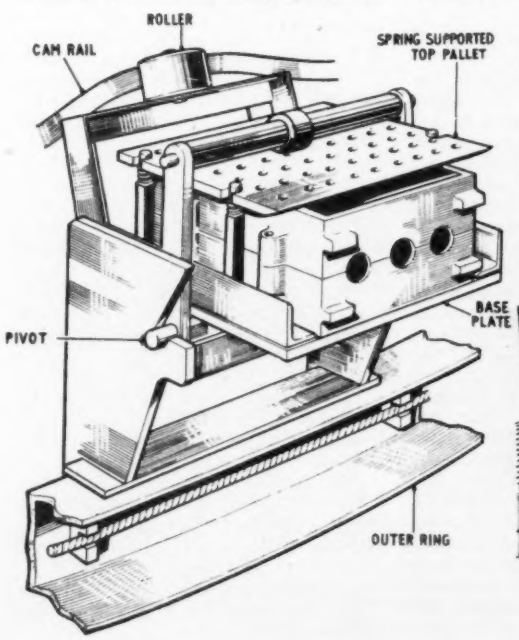
After the necessary cooling period, the poured moulds are automatically restored to the horizontal position and unclamped ready for removal at the shake-out.

Pouring Arrangement

To pour the moulds in the vertical position, it is advisable that the ladle lip be kept as close as possible to the "downgate", and the ladle height adjusted about its lip during the pouring of the metal. It is also essential, bearing in mind the method of approach to the design of the system, that the heavy fatigue associated with this operation be eliminated and consequently the simple mechanism that can be seen in Fig. 10, has been evolved.

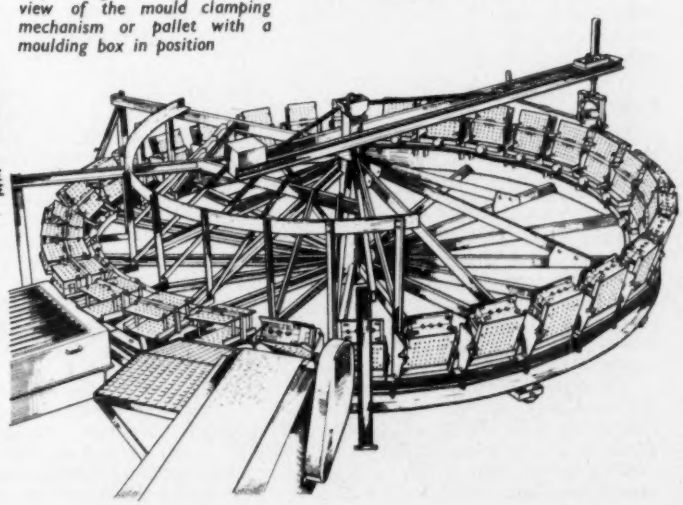
Standard foundry ladles are used but the carrying handle is modified. The ladle and carrying handle are supported in a self-adjusting cradle suspended from a swinging arm so that in plan the ladle moves around an arc whose centre coincides with the centre of the rotary track. The cradle consists of two hooks and is supported by a compression spring working in a housing which, in addition to catering for the rotary and vertical movements, also allows the ladle to be moved inwards or outwards as desired. The arm from which the mechanism is suspended, rotates about the centre of the mould conveyor and has a balance weight fitted at the opposite end to facilitate rotation and eliminate operator fatigue. The ladle handle is provided with two trunnions, one on each side of the ladle, which pivot within the two hooks of the cradle. The cradle support spring is loaded to equal the combined weight of the cradle handle assembly and consequently it adjusts its height as the metal poured reduces the total weight of the assembly.

The shake-out is a conventional vibratory frame-type machine fixed to the foundry floor and positioned over an underground sand return conveyor. The box parts are placed on a gravity



Below : Fig. 10—A view of the rotary casting conveyor showing the position of the mould pallets at various stages of its rotation

Left : Fig. 11—A detailed view of the mould clamping mechanism or pallet with a moulding box in position



roller conveyor, returning to the moulding machine to complete the cycle.

Sand Processing

The used sand is carried by the underground conveyor beneath the magnetic separator, seen in Fig. 5, to remove any foreign ferrous metal. It is then discharged into a bucket elevator and raised to a rotary screen above the storage hopper. Located beneath the storage hopper is a measuring hopper, or feeder gate for discharging a given quantity of sand into the mill. It will be appreciated that with the wide range of alloys for which the plant is suitable, there will also be a considerable variation in the sand condition requirements. The sand system can therefore be equipped with the sand mill most suitable for a specific requirement, and may be either continuous or batch.

When the sand leaves the mill it is neither heavy nor close, as during the whole process of preparation the stirrers and ploughs built into the machine have prevented the sand from becoming lumpy or lying in cakes on the pan bottom. It is then discharged into a disintegrator where it is broken down into a free flowing consistency, to be raised once more into the reservoir hopper supplying the sand feed conveyor of the moulding machine. A general view of the reservoir hopper and sand feed elevating mechanism is given in Fig. 5. The hopper is provided with an adjustable gate which is used to control the rate of sand input into the semi-rotary hopper of the moulding machine. The reservoir hopper and its associated conveyor are in practice one of the independent units which form the complete system. It is important to ensure that the semi-rotary hopper in the moulding machine is filled uniformly and consequently the discharge end of the conveyor is fitted with a reciprocating sand chute driven from the head pulley shaft. This ensures that irrespective of the depth of sand on the belt it is distributed evenly into the hopper.

Whichever type of sand processing installation is provided, the sand cycle is controlled automatically by electrical sequence control gear.

Control Panel

The control unit for the moulding machine has been described. However, there are many electrical devices in the complete installation, all of which must be in sequence with the instigator of movement — the moulding machine. The central electrical control panel, houses "direct-on" motor starters for bucket elevators, elevator feed conveyor, rotary screen, magnetic separator, sand return conveyor, shake-out, mould conveyor and core conveyor.

There is also a star-delta starter for the sand mill, a contactor type switch controlling the rectifier, which supplies D.C. for the magnetic separator, and a control circuit transformer. Arrangements have been made for the unit to be protected from general dust and dirt in the foundry.

At the top of the panel are mounted two indicator lamps showing that the control circuit and rectifier are energized. The circuit is so arranged that all the motors must be started in their correct sequence. This prevents a "pile-up" occurring in any part of the plant, but for test and maintenance purposes a switch is fitted which allows any motor to be started in any order. This switch is fitted inside the panel and is for use by authorized persons only and not the general foundry.

Flexibility

The moulding machine, as described in this article, is capable of producing at least 240 completed moulds per hour. The speed of the circular clamping and pouring conveyor track is variable to give a cooling period of from 4 to 8 min., depending on the output from the moulding machine, the type of alloy and the casting section. There are instances, however, where it is possible to reduce the cooling period considerably as, for example, where very small light castings are being produced.

It is not always necessary for a foundry to have all the plant described. Many foundries are equipped with adequate sand re-conditioning facilities and it is only necessary to ensure that a steady controllable flow of sand in the correct condition reaches the rotary hopper on the moulding machine. Again, though the plant described has been arranged to give reasonable line flow of the basic moving elements of sand, metal and moulding boxes, it can nevertheless, be grouped to suit almost any shape of shop and to meet any particular local requirements. All of the conveyor tracks, for example, can be made available in any length or shape, without altering the basic concept of the plant.

Economics

The foundryman, considering the replacement of manual or semi-mechanized methods, by a unit of this type would naturally use the results obtained in his own foundry as a basis of comparison. In general terms, the smaller foundries find it difficult to obtain an accurate cost assessment as manual moulding includes several ancillary operations, the performance of which may be carried out in some instances by several operators and in other cases by the moulder himself. Such operations include the supply and preparation of sand, positioning of cores, box collection, metal pouring, knock-out of casting, etc. For this reason, a direct comparison of the two methods is difficult as any cost figures chosen for manual operation would not cover all cases likely to be encountered.

Some idea of the degree of comparison may be obtained by considering that with a five-man team operating the unit, a rate of at least 240 completed moulds per hour may be obtained with an output per man per day of the order of say 1,000 lb. This is a tentative figure assuming that fairly light castings of the order of 2½ lb. per box are being produced. (In a number of cases on working installations the casting yield per box has been as high as 8 lb., this excluding, of course, the weight of the running system.)

In terms of manual operation, using a box holding 5 lb. of castings (this normally implies a larger box than used on the automatic machine—say 18×12×5 in.—but this would represent more conventional practice) one operator would have to produce 200 boxes per day in order to approach the conservative output previously mentioned of the automatic machine. In addition, he would have to carry out the attendant operations himself, including sand preparation, metal pouring and all material movement. A rate of production of this order is almost impossible, and even taking into account the variation from foundry to foundry it might be deduced that the production per operator increases three to four times when using a unit of this type The economic benefit of even trebling the output per man under present conditions of high labour charges, and the difficulty of obtaining skilled men needs no emphasis and gives some idea of the rapidity with which the initial capital outlay might be recovered.

Acknowledgements

Acknowledgements are due to the Directors and Management of Rubery, Owen and Co. Limited for encouragement and permission to publish this article and to all those individuals and companies who assisted in the development of the machine throughout its production trials.

A.S.T.M. Test Methods

FOLLOWING the publication recently of Part 2 of the ASTM Book of Standards, the Society has now issued Part 3—"Methods of Test for Metals." This book contains 119 standards (980 pp.) covering: metallography; tension; compression; bending; hardness; impact; magnetic particle testing; hardenability; grain size; creep; radiographic standards; linear expansion; inclusion content; heat-treatment; thermal analysis; corrosion; weight thickness and uniformity of coatings; verification of testing machines; electrical and magnetic properties of metals; density; particle size; sampling; ultrasonic testing.

It does not include methods for chemical and spectrochemical analysis, both of which are dealt with in separate publications.

The ASTM Book of Standards is a triennial publication, supplements being published annually to cover any additions or revisions that arise. Part 3 is available, price $10.00, from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., U.S.A.

New Plant & Equipment

Polishing

SPECIALLY designed for use with liquid polishing compounds and similar heavy materials, two new centre top outlet pressure containers have been introduced by Alfred Bullows and Sons Ltd., Long Street, Walsall.

These containers, which replace the conventional bottom outlet types, have been given the numbers L.1005H and L.1010H, and have capacities of 5 gal. and 10 gal. respectively.

In common with all Bullows pressure containers, they are built to B.S.S. 1101/1943 for a maximum working pressure of 50 lb/in^2, and are hydraulically tested to 100 lb/in^2.

Ram plates are fitted on both models as standard equipment. Agitator gear has been omitted since it is usually undesirable to stir the types of materials for which these containers would be used. Both units incorporate $\frac{3}{4}$ in. O.D. straight-through feed pipes, which have no bends or obstructions to impair the flow of material, and discharge is from the centre of the container head. An outlet of $1\frac{1}{4}$ in. diameter is available as an alternative.

Outlet valves are not considered necessary when liquid polishing compounds are used, but if required for use with less viscous materials they are available at extra cost.

Oven Curing

A COMPREHENSIVE range of "B-W" gas-fired forced convection trolley loading industrial ovens, with a choice of direct or indirect heating, has been introduced by Barlow-Whitney Limited, of 2 Dorset Square, London, N.W.1, and Bletchley.

They are primarily intended for the larger and heavier type of charge, which can be more conveniently handled on mobile platforms or stillages. They can also be supplied with suspension bars, or racks for tray loading, or other special arrangements to requirements, and are suitable for many process heating applications, including baking, curing, pre-heating, polymerizing and stoving. There are two standard versions—series GD/TLO 300 ovens, for temperatures to 300°C., which are direct-fired units in which the products of combustion pass through the working space, and series GIN/TLO 250, indirect-fired types, for temperatures to 250°C., which are so arranged that the products of combustion are excluded from the working space. Sizes in both styles range from about 100-2,000 ft^3, and all models include fully-automatic temperature control, flame failure equipment, and explosion relief panels. Doors may be of the vertical counter-balanced type or hinged pattern, as preferred.

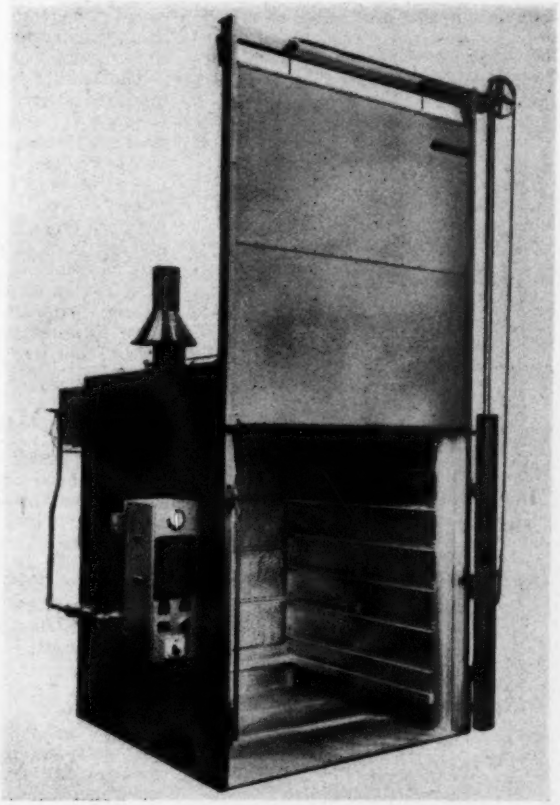
Measuring Dewpoint

THE measurement of dewpoint as a ready estimate of the "carbon potential" of suitable furnace atmospheres is now very widely accepted. Suitable instruments for spot checks are in wide use, but continuous recording allied with automatic control of furnace atmosphere, requires an instrument with quick response, high accuracy and reliability. The Ipsen Dewtronik automatic dewpoint recording controller instrument, now made available in this country by Ipsen Industries Inc., 53 Victoria Road, Surbiton, Surrey, has been developed to meet this specification.

Approximately 25 ft^3/hr. of the atmosphere under test is drawn by a specially-developed pump through a sampling and filtering system, supplied with the instrument. The sampled gas passes over the glass insulated face of a bar cooled by a refrigerating system; two platinum electrodes on the exposed glass face are connected to the "Dewtector," an electronic device which applies suitable potential to the electrodes and "senses" any moisture film immediately it develops. Formation of "dew" triggers a relay and turns on heaters built into the "sensing head." Dispersion of the dew cuts out the heater and the design is such that in operation the sensing head face is maintained within 2°F. of the true dewpoint of the sample gas.

A thermocouple with junction adjacent to the electrodes, signals the

Left : The Bullows pressure container for polishing and other compounds



Right : The Barlow-Whitney gas-fired trolley loading industrial oven

prevailing dewpoint temperature to a standard indicating and recording potentiometer. Mercury switches in this instrument act according to the preset required atmosphere dew point to operate suitable solenoid valves in additive gas lines or motorized ratio controllers, thereby maintaining furnace or generator atmosphere dewpoint within very close limits.

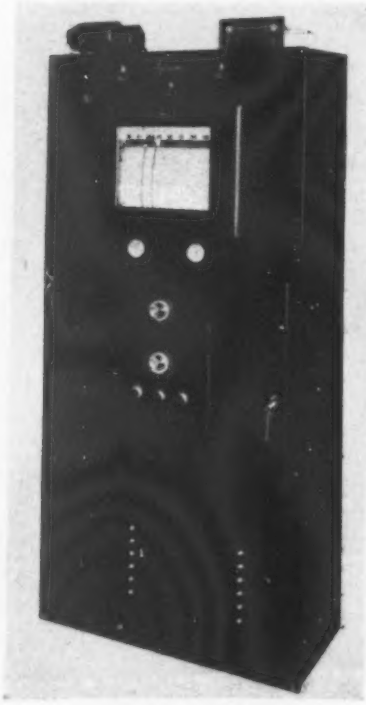
The operating range of 0°-90°F. (or ambient temperature) covers most requirements in this field.

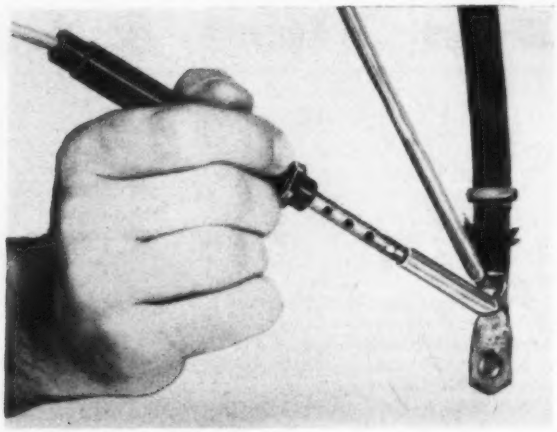
The instrument and accuracy are completely unaffected by all normal atmosphere constituents, including ammonia. Reliability rather than economy has been studied in the specification and construction, and only a very little unskilled maintenance is required. The fact that the instrument is functioning correctly can be determined at a glance at any time, due to the rapid cycling action in normal operation.

Immediately after loading a batch furnace, very moist atmosphere must prevail for a short period, and a standard built-in delay timer arranges for the automatic cessation and resumption of sampling to avoid the system being saturated in this brief period.

Built as a compact unit of good appearance, the Dewtronik is available as a single recording controller or dual recording controller. The latter samples, records and controls two furnaces, two zones of one furnace, or furnace and generator. The speed of response of the instrument makes it possible to supply, as further alternatives, either four-point or six-point recording instruments.

The Ipsen Dewtronik automatic dewpoint recording controller





The Elremco SMS soldering iron being used for soldering 60 amp heavy duty lugs

Soldering

FOR continuous soldering of 60 amp copper lugs, direct soldering to 16 g. steel chassis, and with lower element rating for mass production of television, radio, and any other electronic or transistor assemblies, a sub-miniature soldering iron, type SMS, has been introduced by Electrical Remote Control Co. Ltd., Harlow New Town, Essex. The low voltage soldering iron type SMS has a better performance than the average mains voltage soldering iron, which is much heavier and has twice the power consumption.

The features of the SMS soldering iron are: alternative element ratings of 10 watt, 15 watt, 20 watt, 25 watt, 40 watt, 55 watt and 75 watt. Weight of SMS soldering iron, without cable but with small copper bit, is approximately 1 oz. only. Choice of 20 standard types of exchangeable soldering bits with $\frac{1}{16}$ in. to $\frac{1}{8}$ in. diameter tips. Absolute safety for operators from electric shock. Stem and copper bit are completely insulated from electrical connections. Handle remains always cool and has hexagon anti-roll guard.

Melting

DESIGNED to meet a growing demand for small melts for the special alloying of non-ferrous metals in quantities of up to approximately 100 lb., an electric resistance melting furnace has been introduced by Hedin Ltd., Commerce Estate, South Woodford, London, E.18.

One model, typical of this design, is a lift-out crucible furnace melting 50 lb. per charge. It is rated at 14 kW, the economics being 10 lb. per kW. The furnace has a temperature range up to 1,400°C, and artificial atmosphere inlets are provided to prevent oxidation during the melting cycle. The atmosphere may be piped from an exothermic gas generator or from cylinders.

Further advantages are that it is quiet to operate, free from contamination, and under accurate temperature control. The only maintenance required is an occasional change of elements, which can be done without in any way disturbing the construction of the furnace. The elements are of the silicon carbide type.

These furnaces are built in various sizes to take melts of 10, 15, 30, 45, 60, 75, 90 and 110 lb. Larger furnaces can be built as necessary. All are designed to take standard crucibles.

STANDARD SPECIFICATIONS

Preferred Sizes of Fireclay Refractories. (*B.S.*3056:1959.) *Price* 5*s.*

IN this publication, preferred nominal sizes are specified as a step towards simplification in the range of manufactured fireclay bricks and in their use in furnace construction. Based on a proposed range of sizes submitted by the National Federation of Clay Industries, B.S.3056 has had the full support of the Fireclay Refractories Industry—whose experience has been that the existing demand for a wide variety of sizes has resulted in short runs from machines and frequent changing of moulds. The range of sizes in this standard forms part of a similar but somewhat more extended range issued by the Scottish Employers' Council for the Clay Industries.

Obviously, users' requirements cannot be entirely restricted to the suggested size range—hence the use of the phrase "Preferred sizes" in the standard's title. But it is considered that the selection of sizes offered will meet most normal requirements; and, of course, nothing in the standard should be taken to mean that other types and sizes of firebrick will be unobtainable.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

Industrial News *Home and Overseas*

Apprentices' Competition

It has been decided by the **Association of Bronze and Brass Founders** to postpone the written sections and the judging of castings for the Apprentices' Competition until Wednesday, April 22 next. This will enable the appropriate arrangements to be made more conveniently, and will also give time for additional firms to enter their apprentices in the competition.

Full details of this competition are available from the offices of the association at 69 Harborne Road, Edgbaston, Birmingham, 15.

Aluminium Venture in Ghana

A new joint Canadian-Ghanaian company, Ghana Aluminium Products Limited (Ghanal), is to build a factory at Tema, near Accra, for the manufacture of corrugated aluminium sheets by August this year. A statement issued by the company said the Ghana Government was subscribing 40 per cent of the equity capital and the balance was to be provided by Aluminum Limited of Canada. The Canadian company will make experienced managerial staff available to the new company, and will train Africans, who will be expected eventually to assume senior positions.

Soviet Non-Ferrous Metals

The workers of the lead and zinc mining and smelting enterprise of US/Kamenogorsk, in East Kazakhstan, have issued an appeal to all Soviet workers in the non-ferrous metal industry to step up production, the Industrial and Economic Gazette reports. The enterprise pledges itself to fulfil this year's plan ahead of schedule, to reduce production costs by 0·5 per cent, to step up exploitation of lead from process residues by 30 per cent, and to step up extraction of metal from dust. In addition, the zinc concentrating plant is to be automated.

A Presentation

Relinquishing his position as manager of the Banbury works of **Northern Aluminium Company Ltd.**, Mr. E. L. Ashley is leaving shortly for North America to undertake a special assignment for his company. On Tuesday of last week, in the company of his senior staff, Mr. Ashley was presented with a handsome gold cigarette case by Mr. W. Whittle, production manager and assistant works manager, on behalf of all the employees at the works.

Mr. Ashley had been manager at Banbury for over a quarter of a century and was, in fact, a member of the survey team that selected Banbury as the site for the plant in 1929. He joined the organization in 1927, working in this country and Canada before going to Banbury as sheet mill manager in 1931. Two years later he became works manager.

Floor Space Saving

Considerable saving of floor space in the plating shop of Joseph Lucas Ltd., Birmingham, has recently been achieved by the installation of "Wesculite" water-cooled metal rectifiers totalling 44,000 amperes, supplied by the **Westinghouse Brake and Signal Co. Ltd.** These are unit type water-cooled rectifier sets in cubicles placed on top of the transformer oil tank, which occupies only about one-third of the floor space normally taken up by oil-immersed selenium plating rectifiers.

A Spring Lecture

It has been announced by the Corrosion Group of the **Society of Chemical Industry** that the Spring Lecture will be given this year by Professor W. Feitknecht (University of Berne), who will take as his subject "Studies of the Influence of Chemical Factors on the Corrosion of Metals."

This lecture will be given at 14 Belgrave Square, London, S.W.1, at 6.30 p.m. on Tuesday, April 14.

Mallory No-Chat

News from **Johnson, Matthey and Co. Ltd.** is to the effect that they are now producing and marketing in this country "No-Chat," a sintered tool shank material possessing remarkable characteristics that have gained it wide acceptance in precision machining in the U.S.A.

No-Chat is stated to have an exceptional combination of physical properties; a modulus of elasticity of 40×10^6 lb/in^2, a density of 16·96 gm/cm^3 (0·606 lb/in^3), a coefficient of linear expansion (100°-200°C. of 5×10^{-6} per °C.), together with an ultimate tensile strength of 112,000 lb/in^2

A data sheet on this new material is available on application to the head offices of the company at 73-83 Hatton Garden, London, E.C.1.

Industrial Skin Cleanser

For some time, **Rozalex Limited** have been concerned with the formulation and development of non-gritty and non-caustic skin cleansers to provide a safe alternative method of cleaning work-grimed skin. The company has now produced a new industrial cleanser which, it says, is super-efficient, economical, pleasant, and easy to use.

This new cleanser is of a soft, jelly-like consistency, and is easily applied to the skin, picking up and suspending all grease and grime. No soap or other cleansing substance is required, and it does not run off the hands and, therefore, prevents waste.

Non-gritty, it contains no abrasives which could cause mechanical and physical damage to the skin. The cleanser, equally effective in hot or cold water, has good detergent and suspending qualities, leaving no scum or deposit in the wash bowl. This cleanser can be used in the special Rozalex dispenser which directs exactly the right amount into the palm of the hand. It is obtainable in 7 lb., 14 lb. and 56 lb. tins.

Course for Works Managers

A survey of the need for improved operator training and training techniques will be presented by Mr. W. Douglas Seymour, of the Department of Engineering Production, Birmingham University, at a two-day course for works managers organized by the **Industrial Welfare Society**. The course will be held at the Hotel Rembrandt, Thurloe Place, London, S.W.7, on Wednesday and Thursday, April 29 and 30. The fee for the course is six guineas for delegates from member-firms and seven guineas for non-members.

Digital Computers

The fourth in the series of one-day conferences on digital computers organized by the College of Technology, Birmingham, is to be held at the College on Tuesday, May 5 next, when members of Elliott Bros. Ltd. will deliver an address on various aspects of the subject.

The conference fee is £2, and further details and application forms may be had from the Registrar, College of Technology, Gosta Green, Birmingham, 4.

Coated Tape Dispenser

A recent addition to the **Minnesota Mining and Manufacturing Co. Ltd.** range of taping equipment is the ME71 double-coated tape dispenser. This is said to be easy to load and operate, it peels off the protective liner from "Scotch" brand double-coated tapes, exposing the second adhesive surface, while the tape is being dispensed. The company offers this product for all bonding, splicing and laminating jobs where lengths of tape up to 2 in. in width are required, and the dispenser will handle the "Scotch" brand double-coated tapes Nos. 400, 410 and 43.

Metals Decree in Eire

A report from Dublin states that the Eire Minister for Industry and Commerce has made an Order adding copper-base alloy, copper scrap, zinc scrap, and zinc-base alloy scrap to the list of items subject to export control, as from April 1 last.

Mining Industries Bill

Recent news from Washington is to the effect that Senator Gordon Allcott (Republican, Colorado) has introduced a Bill in the Senate which, he said, would ultimately eliminate the need for U.S. import quotas or production subsidies for the metal and mining industries. The Bill, he told the Senate, would establish a national policy spelling out clearly just what production levels of various metals and minerals the Federal Government wanted to maintain for national security. If accepted, the measure would also protect foreign countries from "over-production by underpaid labour of cheap raw materials," which was undercutting the market of the American metal industry.

The Senator told a press conference that he intended to support Senator Murray's new import quota Bill on lead and zinc. Two other Bills introduced by Senator Allcott were one to provide subsidies for domestically-produced lead and zinc, and another to permit free market trading in gold within the United States.

Tin Statistics

Mine production of tin-in-concentrates in Nigeria amounted to 432 tons in January, 1959. Production (exports) in Bolivia rose sharply in January to 1,851

tons, according to advance statistics published by the International Tin Council. Smelter production of tin metal in the Netherlands declined further in January to 805 tons. Production in Belgium fell to 375 tons in January but recovered to 515 tons in February. Exports of tin metal from Singapore and the Federation of Malaya showed a further recovery in February to 3,668 tons. Exports from the United Kingdom (2,322 tons) and the Netherlands (2,136 tons) were both higher in January.

Imports of tin metal into the U.S.A. were relatively low in November (3,001 tons) but rose in December to 4,227 tons. During January, imports of metal into France rose to 986 tons, while those into the Netherlands fell to 814 tons. Imports into the United Kingdom during January showed little change at 324 tons.

Stocks of tin-in-concentrates at smelters in the United Kingdom totalled 1,300 tons at the end of February, compared with 1,095 tons a month earlier. Stocks at smelters in Belgium were slightly lower at the end of February (719 tons). Stocks of tin metal with consumers in the U.S.A. declined slightly during December to 17,990 tons. Stocks in transit (1,940 tons) and with jobbers and importers (1,050 tons) were both higher at the end of December. Stocks in official warehouses in the United Kingdom again fell in February; at the end of the month they stood at 12,664 tons.

Tinplate shipments in the U.S.A. in January, at 399,566 tons, showed a sharp recovery from the low level of the two previous months. Production of tinplate in the United Kingdom fell to 84,900 tons in January.

A Forthcoming Event

Arrangements for this year's Congress of the **Bureau International De La Recuperation,** to be held at Scheveningen, near The Hague, Holland, next month, include the following events:—

On Wednesday, May 13, in the afternoon, a meeting of the Technical Committee for the Revision of the International Classification of Scrap Metals will be held, and on the following day, also in the afternoon, a meeting of the Non-Ferrous Metal Section will be held.

Factory Equipment Exhibition

On Tuesday next, April 7, the Factory Equipment Exhibition (including heating, ventilation and insulation) will be opened at Earls Court, London, and will remain open daily from 10 a.m. to 7 p.m. until April 17, on which day the exhibition will close at 4 p.m.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses fell by 587 tons and were distributed as follows at the end of last week:—London 5,453, Liverpool 4,130, and Hull 1,166 tons.

Stocks of refined copper rose by 650 tons and were located as follow:—London 2,047, Liverpool 4,319, Birmingham 475, and Manchester 3,025 tons.

Metallurgical Powder Dispenser

Equipment to introduce fluxes into the body of a melt to permit reactions to take place more rapidly and with greater efficiency has been developed by the **British Oxygen Company Ltd.** Known as the "B.O.C. Metallurgical Powder Dispenser," this equipment has been designed for foundries, melting shops and general metallurgical use.

The new equipment is based on the principles of the company's existing dispensers, which are already widely used for the injection of metal powders for gas cutting.

A Die-Cast Enquiry

A Staffordshire engineering firm is interested in hub centres in die-cast light alloy material for instrumentation tapes ½ in. and 1 in. wide. Any firm concerned with this type of product is invited to contact the Editor of this journal.

A Sporting Calendar

As is usual at this time of the year, **The Eyre Smelting Co. Ltd.** has distributed its sporting calendar, the illustrations on which are based on the Empire Games, which were held in Wales. This has enabled the company to provide some very striking photographs of some of the finest athletes in the world in action.

As usual, details of sporting achievements and a diary of leading events for the coming twelve months are given on sheets at the back of the calendar.

Copper Ore Discovery

In its annual report, American Zinc, Lead and Smelting Company states that it has located commercial grades of copper ore in the course of its iron ore drilling programme in Southern Missouri. Reporting on the drilling which is being carried on jointly with Granite City Steel Company, Mr. Howard Young, President of American Zinc, declared: "Out of a total of 12 holes completed on approximately 5,000 acres under lease and option, three give promise of commercial grade of copper ore, with thicknesses up to 100 ft." The company is continuing its drilling programme. The drilling is described as slow, with ultimate average depth from 1,900 to 3,000 ft. The two companies have under lease and option 10,672 acres in the south central portion of the state.

Bolivian Tin

In a despatch from La Paz, the *New York Times* reports that the Bolivian Government faces a new crisis in the nationalized tin mines as the deadline approaches for a 50 per cent reduction in commissary subsidies for 24,000 miners. The paper said labour leaders from 14 of the 16 State mining enterprises met for a last attempt to persuade the Government to postpone the subsidy cut, which was due on April 1. The despatch added that a strike seemed unlikely, because commissary stocks were low and many workers involved in an earlier stoppage this month had received no pay.

U.S. Copper Prospects

A favourable first half for copper this year has been forecast by the United States Commerce Department. Demand for the metal, which appeared late last year, would hold up, with increasing construction taking place and automobile production rising. Consumer inventories would be replenished, partly as a possible hedge against a work stoppage when labour union contracts expired next June 30, the Department said. The forecast was made by the Department's Business and Defence Services Administration in its quarterly report.

"Improved demand resulting from an accelerated construction programme, increased automotive production, a slight improvement in capital expenditures, and indicated replenishment of inventories in the metalworking industries have combined to brighten the picture for the copper industry.

"The replenishment of consumer inventories is attributable not only to the increase in business, but also to upward pressure on prices, and to hedging against the possibility of work stoppages when the three-year contract between labour unions and the major producers expires on June 30."

Discussing copper at the end of 1958, the report said that shipments of copper-base mill and foundry products during the last quarter were up 24 per cent from the third quarter.

"The fourth quarter was the best in 2½ years for brass mill products and for copper-based powder mill products, and in 1½ years for copper wire mill products, and for brass and bronze foundry products," the report declared.

"New supply of refined copper and of copper-base scrap rose substantially in the latter part of 1958, although in the case of refined copper not enough to keep pace with the stepped-up demand from consumers of these materials. The supply increases were due principally to greater output by refiners from domestic ores and from increased receipts of scrap by fabricators.

"Imports of refined copper, up from the third to the fourth quarter, were still far short of restoring raw material imports to the level prevailing in the first half of 1958 and earlier periods.

"Supply and distribution for copper raw materials during the fourth quarter would have shown a more favourable balance on the domestic side but for the continued flow of refined copper in increased quantities to foreign markets," the report said.

Welding News

A reduction in actual welding time by at least half is stated to have resulted from introduction of new techniques in manufacture of components for one of the latest handling systems for rapid and efficient storage or transport of bulk materials. The system, of specially-designed bins used for powdered, granular or liquid materials, is of American origin. It is known as the "Tote System" and is being manufactured in Britain by **Warwick Production Company Limited** to the requirements of Pressoturn Limited, the sole concessionaires outside the Americas.

The system is claimed to offer advantages not normally available with traditional bulk handling methods. The main component is the "Tote Bin," which is welded, in heavy gauge high strength aluminium alloy. Argonarc welding is mainly used in its construction, and recently Lynx welding has been introduced on certain parts. This has enabled Warwick Production to cut actual welding time on these parts by at least half.

The body, which is two-piece wrapper type, has two vertical seams. Fabrication of the bodies is accomplished by means of Argonarc Mark III welding torch, supplied by **British Oxygen Gases Limited.** The torch is mounted on a standard tractor and incorporates a rod feed unit. The "Tote Bin" body is held in a pneumatic clamp type jig, and welding speeds of 20 in/min. are used.

Lynx welding equipment is used on the base, which is fixed to a turntable to facilitate welding of awkward corners. The material used in construction of the bin is ¼ in., $\frac{3}{16}$ in. and ¼ in. H.S.20. N.6 filler wire of $\frac{1}{16}$ in. diameter is used with the Lynx equipment and the rod feed unit. With the manual Argonarc equipment, ⅛ in. diameter N.6 filler wire is used.

Birmingham Metallurgical Society

DINNER AND DANCE

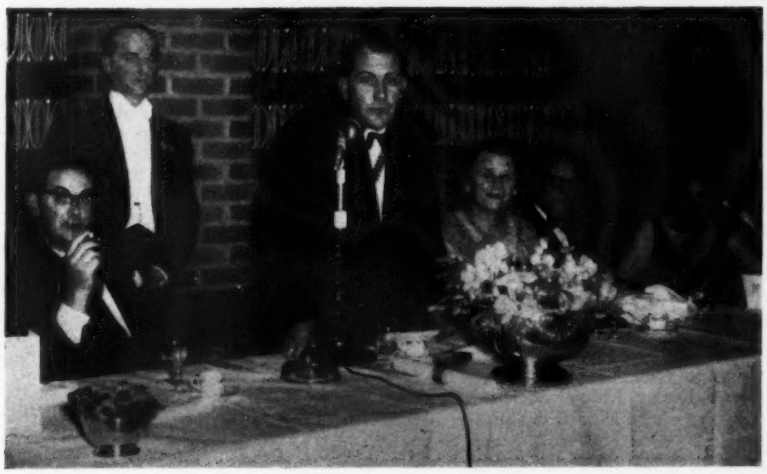
DEPARTING from its usual custom (by following dinner with dancing) the Birmingham Metallurgical Society held its annual dinner on Wednesday of last week at the Pavilion Suite, Edgbaston. On this occasion the **Lord Mayor and Lady Mayoress of Birmingham,** Alderman and Mrs. Donald Johnstone, were the principal guests.

The President of the Society, **Dr. R. King,** B.Sc., A.R.I.C., A.I.M., proposing the toast "The City of Birmingham," recalled that the society was the oldest metallurgical association in the country so far as non-ferrous metals were concerned, and referred to the close association that had always been maintained with the Institute of Metals. The reply to this toast was given by the Lord Mayor.

Proposing the toast of "Our Guests," **Mr. R. Chadwick,** M.A., F.I.M., expressed the pleasure of having among the guests **Mr. W. H. B. Wesson,** T.D., President of the South Staffordshire Iron and Steel Institute, the oldest metallurgical society in the country, and also welcomed the Lord Mayor and Lady Mayoress; **Dr. Maurice Cook,** C.B.E.; **Mr. N. I. Bond-Williams; Dr. C. E. Homer,** President of the local section of the Institute of Metals; and others. The response to this toast was made by Mr. Bond-Williams.

At the conclusion of the dinner, the President called on **Mr. Kelvin S. B. Rose,** of Birmingham University, the winner of this year's students' essay prize, to receive his award—a scroll and cheque for 15 guineas—from the Lady Mayoress. The runner-up in this competition was **Mr. Peter W. Graves,** also a student at Birmingham University.

Dr. R. King, President of the Birmingham Metallurgical Society proposing the toast of "The City of Birmingham." The illustration also shows The Lord Mayor of Birmingham, the Lady Mayoress, Dr. Maurice Cook, Mrs. Cook and Mr. N. I. Bond-Williams



Forthcoming Meetings

April 4—Institute of British Foundrymen. East Midlands Branch. The College of Arts, Derby. Annual General Meeting. 6 p.m.

April 6—Institute of British Foundrymen. Sheffield Branch. The College of Commerce and Technology, Pond Street, Sheffield. "Radiofrequency Core and Mould Drying." K. D. Richardson. 7 p.m.

April 7 — East Midlands Metallurgical Society. The Electricity Demonstration Theatre, Carrington Street, Nottingham. Annual General Meeting, followed by "Metallurgical Examination of Failures." G. A. Cottell. 7.30 p.m.

April 7—Institute of Metals. Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. Annual General Meeting, followed by a Coloquium on Modern Joining Techniques: (a) Electron Bombardment; (b) Ultrasonic Applications; (c) Non-Metallic Bonding. 7 p.m.

April 9—Liverpool Metallurgical Society. The Library, Department of Metallurgy, The University, 146 Brownlow Hill, Liverpool, 3. "Boron in Steel." F. B. Pickering. Followed by Annual General Meeting. 7 p.m.

April 9—Institute of British Foundrymen. Lincolnshire Branch. Technical College, Cathedral Street, Lincoln. Annual General Meeting, followed by Technical Film Show. 7.15 p.m.

April 9—Institute of Metals. London Local Section. 17 Belgrave Square, London, S.W.1. Annual General Meeting. 6.30 p.m.

April 10—Institute of British Foundrymen. Tees-Side Branch. Teesdale Hall, Head, Wrightson and Co. Ltd., Thornaby-on-Tees. Annual General Meeting. Presentation of Apprentice Competition Awards and Prize-winning Entry in Short-Paper Competition. 7.30 p.m.

Men and Metals

At the annual general meeting of General Refractories Limited, to be held this month, **Sir Ronald W. Matthews,** D.L., J.P., will be succeeded as chairman of the company by **Mr. R. A. Kirkby,** J.P., who joined the company in 1928, was made a director in 1929, and appointed managing director in 1938. **Mr. J. Gregory,** production director, will take over the position of managing director in June next. **Mr. A. McKendrick,** M.B.E., M.C., is to retire from the board.

It has been announced by Northern Aluminium Company Limited that **Mr. E. L. Ashley,** manager of the company's works at Banbury, is to undertake a special assignment, and will be leaving for North America shortly. He is to be succeeded by **Mr.**

C. I. F. Mackay, who is at present assistant works manager and production manager at the Rogerstone works. Mr. Mackay joined the company in 1931 at Banbury, and moved to Rogerstone in 1951.

A member of the Firth Cleveland group, Keeton, Sons and Company Limited announce the appointment of **Mr. C. W. Simpson,** A.C.C.S., as company secretary and accountant.

Joining Metal Industries Limited as an assistant to the company secretary, **Mr. R. N. Harding,** A.C.I.S., has for the past ten years been assistant to the secretary of Allied Ironfounders Limited.

In succession to **Professor F. C. Thompson,** who is retiring, the Council of the University of Manchester have appointed **Mr. C. R. Tottle** as Professor of Metallurgy and director of the metallurgical laboratories at the University as from July 1 next. Mr. Tottle is at present deputy director and head of the reactor division at the United Kingdom Atomic Energy Authority's industrial group at Dounreay.

At the annual general meeting of the British Compressed Air Society, **Mr. E. A. Martin** (Padley and Venables Limited) was elected President for the ensuing year; **Mr. J. C. Greig** (Atlas Copco (G.B.) Limited) as vice-president; **Mr. T. C. Hore** (Holman Bros. Limited) as hon. technical director.

It has been announced by Westinghouse Brake and Signal Company Limited that **Mr. George William Dunkley,** O.B.E., has been appointed a director of the company.

Metal Market News

NOT unnaturally, the period around any holiday time is usually notable for quiet trading, and this year has been no exception, although last week is reported as being fairly active in the circumstances. On the market, business was about up to average for the curtailed operating period, which came to an end with Thursday's midday market. The Exchange reopened on Tuesday last, but many factories that had worked on Good Friday did not make a start after the holiday until Wednesday. With the exception of tin, which lost ground, the base metals were steady, although copper closed below the best. Zinc and lead, and especially the latter, were depressed on news that a Bill would be introduced by mining Senators to bring both lead and zinc imports under a more stringent control. These two metals are already subject to a quota system, and with the threat of additional discouragement to imports it is no wonder that lead set up in midweek a new low record since the market reopened in October, 1952, at £66 5s. 0d. for the current period. Some recovery was seen subsequently. Apparently the object of the Bill is to support domestic prices in the States at 15½ cents per lb. for lead and 13½ cents for zinc, the idea being to regulate imports at such a level as to maintain these prices. Although zinc is affected by this plan, it suffered less in value on the London market than lead did.

Stocks of copper in L.M.E. warehouses were reported up again by 549 tons to 9,126 tons, and there is good reason to believe that a still higher level will be achieved. After all, against a background of a turnover amounting to around 12,000 tons per week, a stock of 9,000 tons is not really enough. However, matters have improved since late January, when the figure was only 4,361 tons. During the week the Belgian price was brought down by 1 franc to 34·25 francs per kilo, and it was generally supposed that the custom smelters were prepared to sell at 33 cents. However, after the severe setback of the week before a satisfactory improvement was seen, and on Wednesday cash was quoted at £247 15s. 0d., with three months 10s. cheaper. The turnover in the shortened week was 9,800 tons and the close £246 5s. 0d. for both positions, so that the backwardation was eliminated. On balance, there was a gain of £1 15s. 0d. in cash and of £3 in three months. As things look, and provided warehouse stocks continue to improve, we may well see a contango established again.

Stocks of tin are still falling, and at the beginning of last week were reported 402 tons down at 11,336 tons. As already mentioned, the trend was easier, and after a turnover of 920 tons cash closed £5 10s. 0d. lower on balance at £776 and three months £4 down at £781, the contango having widened to £5. There does not seem to be any special feature in tin at the present time, and last week's setback was probably due to some liquidation based on lack of demand before the holidays. Mention has already been made of the most recent developments in lead and zinc as regards American action. In lead, there was a turnover last week of 5,875 tons, and on balance March, closing well above the worst, stood at £68, with June at £69 15s. 0d. In zinc some 7,000 tons changed hands, March closing 25s. down at £73 5s. 0d. while June, at £73, was £1 lower on balance.

Birmingham

With works closed on Monday and Tuesday for the Easter holiday, business has been slow in the metal-using industries. The motor trade absorbs a considerable amount of raw material from works making stampings and pressings, but car manufacturers have been singularly unfortunate in regard to labour troubles throughout the first quarter of the year, and even now, after a period of about six weeks, one dispute remains unresolved. The outlook is better in the building trade. Exports in the metal trades generally are lower than they were a year ago, and manufacturers find it difficult to secure new outlets owing to severe competition from the Continent and further afield.

Shropshire's last blast furnace, one owned by the Lilleshall Iron and Steel Company, made its final cast of 25 tons prior to the Easter holiday, and was blown out after being in use night and day for two-and-a-half years. Thus, the county, which has had blast furnaces for 400 years, has now ceased to play any part in pig iron production. Owing to the fact that supplies of iron ore in the district have run out and have to be brought long distances, the company find it uneconomical to continue. The iron and steel trade in the Midland area generally is quiet, with the exception of the steady call for sheets for the motor industry and a good demand for material for electrical equipment used in power stations. The structural steel market continues slow. Makers of heavy iron castings are busy on work for the engineering industries.

New York

Copper futures were firmer last week-end, reflecting the advance in London, with a fair volume noted. Covering and new buying was reported. Custom smelters continued to report slow volume of sales, with some informed sources indicating that custom smelters would sell at 33½ cents, and possibly below if firm bids developed. Scrap copper was steady to-day. Producers continued to report greater demand than available supply. Tin was quiet and softer, with some business reported in the lower levels. Lead and zinc were quiet. The lead price was considered by traders under greater pressure, following a quarter cent price decline in the Canadian lead price to 10¼ cents a lb. f.o.b. Montreal/Toronto.

Scrap copper, after early firmness, broke on the decline in London and heavy speculative selling on the Commodity Exchange in N.Y. Scrap copper offerings increased sharply, with custom smelters reporting heavy intake latterly at 27½ cents, with the price falling thereafter to 27¼ cents per lb. Custom smelters reported brisk electrolytic sales at 34 cents during the week, but latterly said interest fell off sharply. Lead scrap was barely steady and quiet, while zinc scrap was steady and quiet.

Inspiration Consolidated Copper Company has announced that it will spend 15,850,000 dollars over the next two or three years to develop an underground mine at Christmas, Arizona. Ore reserves are estimated at 20,000,000 tons, averaging 1·83 per cent copper or about 660,000,000 lb. of recoverable copper. The Christmas Mine is about 45 miles south of Inspiration's two open-cast operations in the Globe area. The Thornton and Live Oak open-cast mines produced 83,641,275 lb. of copper in 1958.

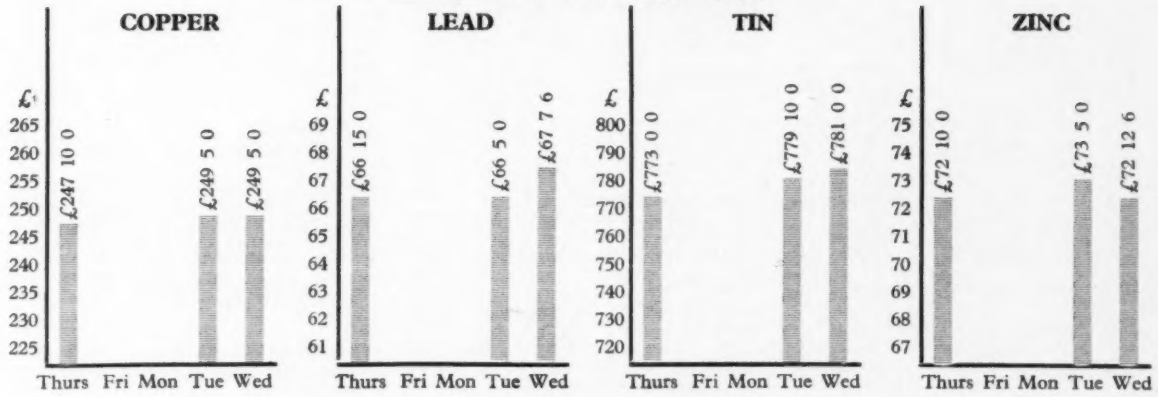
The zinc industry in 1958 was characterized by low demand, drastic declines in mine and smelter production, large imports and mounting producer stocks, according to the Bureau of Mines, United States Department of the Interior. Combined smelter production (828,900 short tons) and imports of slab zinc (195,200 tons) totalled 1,024,100 tons in 1958. Consumption of slab zinc in the same period was 821,000 tons. Mine production of zinc in the U.S. fell 24 per cent below the 1957 total, and was the lowest yearly rate since 1933.

Output of slab zinc at U.S. smelters fell 22 per cent below 1957 to 828,900 tons. In January, 82,300 tons of slab zinc was produced, but by March output had dropped to 72,100 tons and by June only 67,000 tons were produced. During the second half of the year, output reached the low of 62,900 tons in August; thereafter monthly production rose to 75,500 tons in December. Of the total produced, 781,700 tons were primary slab zinc and 47,200 tons were re-distilled slab. The quantity of slab zinc available to consumers (exclusive of old stocks) was 953,500 tons. Reported consumption, including an estimated consumption of 10,800 tons by consumers reporting on an annual basis only, was 820,700 tons—a 12 per cent decline from the 1957 total of 935,600 tons.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 26 March to Wednesday 1 April 1959



Primary Metals

All prices quoted are those available at 2 p.m. 1/4/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite per unit			—	
Copper H.C. Electro	ton	249	5	0
Fire Refined 99·70%	„	248	0	0
Fire Refined 99·50%	„	247	0	0

		£	s.	d.
Copper Sulphate	ton	79	0	0
Germanium	grm.		—	
Gold	oz.	12	9	1¾
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	67	7	6
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	245	0	0
Mercury	flask	77	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	5	15	0
Platinum	„	28	10	0
Rhodium	„	40	0	0
Ruthenium	„	14	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅛
Tellurium	lb.		15	0
Tin	ton	781	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	72	10	0
Dust 95/97%	„	109	0	0
Dust 98/99%	„	115	0	0
Granulated 99+%	„	97	10	0
Granulated 99·99+%	„	110	11	3

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏£/ton	**Canada** c/lb ≏£/ton	**France** fr/kg ≏£/ton	**Italy** lire/kg ≏£/ton	**Switzerland** fr/kg ≏£/ton	**United States** c/lb ≏£/ton
Aluminium		22.50 185 17 6	210 157 10	375 221 5	2.50 212 10	26.80 214 10
Antimony 99.0			220 165 0	445 262 10		29.00 232 0
Cadmium			1,350 1,012 10			145.00 1.160 0
Copper						
Crude				490 289 2 6		
Wire bars 99.9 Electrolytic	34.25 252 0	30.50 252 0	344 258 0		3.05 295 5 0	31.50 252 0
Lead		10.25 84 12 6	98 73 5	164 96 15	.87 74 0	11.50 92 0
Magnesium						
Nickel		70.00 578 5	900 675 0	1,200 708 0	7.50 637 10	74.00 592 0
Tin	111.75 822 10		1,111 833 5	1,500 885 0	9.60 816 0	102.37 819 0
Zinc						
Prime western		11.25 93 0 0				11.00 88 0
High grade 99.95		11.85 97 17 6				
High grade 99.99		12.25 101 2 6				
Thermic			109.00 81 15			
Electrolytic			117.00 87 15	170 100 7 6	.99 84 2 6	12.25 98 0

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Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 1/4/59

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0

†Aluminium Alloys (Secondary)		
B.S. 1490 L.M.1 .... ton	—	
B.S. 1490 L.M.2 .... „	—	
B.S. 1490 L.M.4 .... „	—	
B.S. 1490 L.M.6 .... „	—	

*Aluminium Bronze			
BSS 1400 AB.1..... ton	240	0	0
BSS 1400 AB.2..... „	246	0	0

*Brass	£	s.	d.
BSS 1400-B3 65/35 .. ton	161	0	0
BSS 249 ..... „		—	
BSS 1400-B6 85/15 .. „	202	0	0

*Gunmetal			
R.C.H. 3/4% ton .... „		—	
(85/5/5/5) ..... „	201	0	0
(86/7/5/2) ..... „	208	0	0
(88/10/2/1) ..... „	254	0	0
(88/10/2/½) ..... „	266	0	0

*Manganese Bronze			
BSS 1400 HTB1.... „	190	0	0
BSS 1400 HTB2.... „		—	
BSS 1400 HTB3.... „		—	

Nickel Silver				
Casting Quality	12%	„	227	0 0
„ „	16%	„	237	0 0
„ „	18%	„	247	0 0

*Phosphor Bronze			
B.S.1400 P.B.1.(A.I.D. released) ..... „		—	
B.S. 1400 L.P.B.1.... „	217	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ..... ton	262	0	0
15% ..... „	271	0	0

Phosphor Tin		
5% ..... „	—	

Silicon Bronze			
BSS 1400-SB1 ..... „	264	0	0

Solder, soft, BSS 219			
Grade C Tinmans.... „	359	0	0
Grade D Plumbers.. „	288	0	0
Grade M ..... „	394	6	0

Solder, Brazing, BSS 1845		
Type 8 (Granulated) lb.	—	
Type 9 „ „	—	

Zinc Alloys			
Mazak III ..... ton	103	16	3
Mazak V ..... „	107	16	3
Kayem ..... „	113	16	3
Kayem II ..... „	119	16	3
Sodium-Zinc ..... lb.		2	6

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.		2	8½
Sheet 18 S.W.G. „		2	10½
Sheet 24 S.W.G. „		3	1½
Strip 10 S.W.G. „		2	8½
Strip 18 S.W.G. „		2	9½
Strip 24 S.W.G. „		2	11
Circles 22 S.W.G. „		3	2½
Circles 18 S.W.G. „		3	1½
Circles 12 S.W.G. „		3	0½
Plate as rolled ..... „		2	8
Sections ..... „		3	2
Wire 10 S.W.G. .... „		2	11½
Tubes 1 in. o.d. 16 S.W.G. ..... „		4	1

Aluminium Alloys			
BS1470. HS10W.			
Sheet 10 S.W.G. „		3	1
Sheet 18 S.W.G. „		3	3½
Sheet 24 S.W.G. „		3	11
Strip 10 S.W.G. „		3	1
Strip 18 S.W.G. „		3	2½
Strip 24 S.W.G. „		3	10½
BS1477. HP30M.			
Plate as rolled..... „		2	11
BS1470. HC15WP.			
Sheet 10 S.W.G. „		3	9½
Sheet 18 S.W.G. „		4	2
Sheet 24 S.W.G. „		5	0½
Strip 10 S.W.G. „		3	10½
Strip 18 S.W.G. „		4	2
Strip 24 S.W.G. „		4	9½
BS1477. HPC15WP.			
Plate heat treated.. „		3	6½
BS1475. HG10W.			
Wire 10 S.W.G. „		3	10½
BS1471. HT10WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „		5	0½
BS1476. HE10WP.			
Sections ..... „		3	1½

Brass			
Tubes..... „		1	11½
Brazed Tubes..... „		—	
Drawn Strip Sections „		—	
Sheet ..... ton		—	
Strip ..... „	260	5	0
Extruded Bar..... lb.		2	0½
Extruded Bar (Pure Metal Basis) ..... „		—	

Brass			
Condenser Plate (Yellow Metal)..... ton	195	0	0
Condenser Plate (Naval Brass) ..... „	207	0	0
Wire ..... lb.		2	8½

Beryllium Copper			
Strip ..... „	1	4	11
Rod..... „	1	1	6
Wire ..... „	1	4	9

Copper			
Tubes ..... lb.		2	4½
Sheet ..... ton	276	5	0
Strip ..... „	276	5	0
Plain Plates ..... „		—	
Locomotive Rods .... „		—	
H.C. Wire ..... „	298	5	0

Cupro Nickel			
Tubes 70/30 ..... lb.		3	7¾

Lead			
Pipes (London) .... ton	108	5	0
Sheet (London) .... „	106	0	0
Tellurium Lead .... „	£6 extra		

Nickel Silver			
Sheet and Strip 7% .. lb.		3	9½
Wire 10% ..... „		4	4

Phosphor Bronze			
Wire ..... „		4	2½

Titanium (1,000 lb. lots)		
Billet over 4″ dia.-18″ dia. lb.	63/-	64/-
Rod 4″ dia.-·250″ dia. „	75/-	112/-
Wire under ·250″ dia.-·036″ dia. ..... „	146/-	222/-
Sheet 8′ × 2′ × ·250″-·010″	88/-	157/-
Strip ·048″-·003″..... „	100/-	350/-
Tube..... „		300/-
Extrusions ..... „		120/-

Zinc			
Sheet ..... ton	111	0	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 31/3/59.

Aluminium	£
New Cuttings	145
Old Rolled	125
Segregated Turnings	96

Brass	
Cuttings	170
Rod Ends	150
Heavy Yellow	132
Light	127
Rolled	160
Collected Scrap	129
Turnings	143

Copper	
Wire	225
Firebox, cut up	218
Heavy	215
Light	210
Cuttings	225
Turnings	205
Braziery	172

Gunmetal	£
Gear Wheels	194
Admiralty.....	194
Commercial	172
Turnings	167

Lead	
Scrap	56

Nickel	
Cuttings	—
Anodes	550

Phosphor Bronze	
Scrap	172
Turnings	167

Zinc	
Remelted	58
Cuttings	53
Old Zinc	37

Financial News

Thomas Bolton and Sons

Net profit, 1958, £41,423 (£71,941) and dividend 10 per cent (same). Current assets £3,112,637 (£3,101,246), liabilities £1,111,889 (£1,088,169) including overdraft £246,410 (£65,377). Capital commitments £237,000 (£85,000). Lower profits were due to uneconomical prices obtaining in export markets for sulphate of copper.

James Booth and Co. Ltd.

No dividend on Ordinary for 1958 (9 per cent). Group net profit £104,143 (£141,417) after tax of £31,194 (£158,101). To general reserve £50,000 (£156,358), re-equipment and development account £50,000 (nil), staff pension account £10,000 (nil), forward £330,003 (£342,300).

Elkington and Co. Ltd.

Dividend 17½ per cent for 1958 (5 per cent). Profit £104,209 (£78,158), before tax of £450 (£6,600). To general reserves £50,000 (same), forward £13,444 (£13,160).

Albright and Wilson Ltd.

Group trading profits are shown at £5,388,000 (against £4,754,000). After taxation and depreciation charges, net profits are given as £1,723,000 (against £1,612,000). A final Ordinary dividend is recommended of 13 per cent, making 17 per cent for the year.

Aluminium Corporation

Net profit 1958 £81,596 (£82,904) and dividend 17½ per cent (same). Fixed assets £668,798 (£301,088), net current assets £118,617 (£425,718). Commitments £53,000 (£366,000).

Harrison (Birmingham) Ltd.

Ordinary dividend 15 per cent (12½ per cent), bonus of 2½ per cent (same). Group profits £123,321 (£82,813), after taxation. Carry forward is £307,558 (£268,447).

Aluminium Ltd.

Conditions of over-supply and strenuous competition affected the free world aluminium industry with "increased intensity" in 1958, Aluminium Limited states in its annual report. The company is confident that the over-supply of the metal is temporary, as demand for aluminium is increasing, but if the recent rate of consumption growth is maintained the balance between supplies and requirements is unlikely to be fully corrected for several years. In view of this, efforts must be made to find new applications and markets for aluminium. Aluminium Limited last year had a net income of 22,464,510 dollars, or 74 cents per share, compared with 41,422,456 dollars, or 1·37 dollars per share, in 1957. The decline is attributed to "a combination of several factors, including higher depreciation and interest charges, lower prices, reduced volume of metal sales, and losses on the company's shipping operations."

The financial results of Aluminum Company of Canada Limited were also announced last week, showing a net income of 20,096,298 dollars (including 8,797,505 dollars resulting from the consolidation of a subsidiary acquired from Aluminium Limited as from January 1, 1958) compared with 26,498,359 dollars in 1957. Alcan's accounts are, in turn, consolidated in those of its parent company.

In his comment to shareholders, Mr. Nathaniel V. Davis, President, said that although consumption of primary aluminium in many countries was at record or near-record levels last year, total consumption of primary in the free world was estimated at nearly 100,000 tons less than in 1957. This was due to lower demand in the United States, the largest single consuming area, reflecting the downturn in general economic activity. By the end of the year there was definite evidence of a recovery in demand in the company's three largest markets — the United Kingdom, the United States and Canada — while several other markets showed a continuance of the good demand levels that had held most of the year.

The accounts of ten operating companies in which Aluminium Limited owns 50 per cent or more of the equity are not consolidated in the company's accounts but are carried as an investment which stood at 15,000,000 dollars at the end of 1958. These companies, of which six are semi-fabricators and four are primarily smelting operations, had net total assets of 100,000,000 dollars at the year end.

Stabilization Act

Recent news from Washington states that co-sponsorship of the Murray Lead/Zinc Stabilization Act of 1959 has been announced by U.S. Senator Frank E. Moss. The Bill would stabilize the domestic price of lead at 15·50 cents/lb. and that of zinc at 13·50 cents/lb. during a base quarter. Thereafter, the price would be tied, on a quarterly basis, to changes in the average price index. Under the new legislation, the Secretary of Commerce would be charged with the duty of keeping the price at prescribed levels through a system of import quotas. These would supersede present quotas issued by proclamation of the President last autumn. Each quarter, the Secretary would determine what quantities of the two metals could be imported without causing the price to fall below the prescribed minimum. Each exporting country would be assigned quotas based on the percentage of United States imports of the two metals from that country in 1956.

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for the year 1958, have been issued by the Ministry of Supply as follows (in long tons):—

Virgin Aluminium	
Production	26,354
Imports	210,433
Despatches to consumers	232,499
Secondary Aluminium	
Production	109,746
Virgin content of above	10,727
Despatches (including virgin content)	109,753
Secondary in Consumption (per cent)	
Wrought products	5·7
Cast products	83·6
Destructive uses (aluminium content irrecoverable)	65·0
Total consumption	28·5
Scrap	
Arisings	146,516
Estimated quantity of metal recoverable	102,956
Consumption by:	
(a) Secondary smelters	132,419
(b) Other uses	14,428
Despatches of wrought and cast products	
Sheet, strip and circles	134,582
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	31,368
(b) Tubes (i) extruded	2,620
(ii) cold drawn	6,168
(c) (i) Wire	22,191
(ii) Hot rolled rod (not included in (c) (i)	1,540
Forgings	3,665
Castings: (a) Sand	19,046
(b) Gravity die	44,446
(c) Pressure die	17,607
Foil	23,291
Paste	3,221
Magnesium Fabrication	
Sheet and strip	94
Extrusions	703
Castings	1,825
Forgings	7¼

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£205.17.6)	235
Heavy copper	(£205.17.6)	235
Light copper	(£170.17.6)	195
Heavy brass	(£113.17.6)	130
Light brass	(£92.0.0)	105
Soft lead scrap	(£57.0.0)	65
Zinc scrap	(£39.10.0)	45
Used aluminium unsorted	(£78.16.0)	90
France (francs per kilo):		
Electrolytic copper scrap	(£198.15.0)	265
Heavy copper	(£198.15.0)	265
No. 1 copper wire	(£187.10.0)	250
Light brass	(£116.5.0)	155
Zinc castings	(£49.10.0)	66
Lead	(£63.15.0)	85
Aluminium	(£120.0.0)	160
Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£197.12.6)	335
Aluminium copper alloy	(£126.17.6)	215
Lead, soft, first quality	(£76.15.0)	130
Lead, battery plates	(£43.12.6)	74
Copper, first grade	(£227.2.6)	385
Copper, second grade	(£215.7.6)	365
Bronze, first quality machinery	(£212.10.0)	360
Bronze, commercial gunmetal	(£183.0.0)	310
Brass, heavy	(£147.10.0)	250
Brass, light	(£132.15.0)	225
Brass, bar turnings	(£135.15.0)	230
New zinc sheet clippings	(£56.0.0)	95
Old zinc	(£46.0.0)	78

THE STOCK EXCHANGE

Business Keeps Good But Movements Are Irregular

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 31 MARCH	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	25/6	+1/1½	9	10	7 1 3	24/10½	23/3	24/9	17/6
400,000	2/-	Anti-Attrition Metal	1/6		4	8½	5 6 9	—	—	1/9	1/3
41,305,038	Stk. (£1)	Associated Electrical Industries ...	55/-xd		15	15	5 7 9	59/-	54/-	58/9	46/6
1,609,032	1	Birfield	47/6	+6d.	15	15	6 6 3	59/-	47/6	62/4½	46/3
3,196,667	1	Birmid Industries	72/3	—1/3	17½	17½	4 17 0	76/10½	72/-	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	37/-		11	10	5 19 0	40/4½	36/1½	39/-	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	16/3		5	5	6 3 0	16/3	15/-	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/9		6	6	6 15 3	18/1½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	23/-		10	12½	7 2 9	28/3	27/6	28/9	24/-
300,000	1	Ditto Pref. 5%	15/6		5	5	6 9 0	15/6	15/-	16/-	15/-
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6		7	7	6 16 6	—	—	20/4½	19/-
1,500,000	Stk. (£1)	British Aluminium Co. Pref 6% ...	19/6		6	6	6 3 0	19/7½	18/9	20/-	18/4½
15,000,000	Stk. (£1)	British Insulated Callender's Cables	48/3		12½	12½	5 3 6	53/-	47/6	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	54/6	—9d.	10	10	3 13 6	56/-	49/3	52/-	28/3
600,000	Stk. (5/-)	Canning (W.) & Co.	25/4½		25 + *2½C	25	4 18 6	25/6	24/9	25/3	19/3
60,484	1/-	Carr (Chas.)	2/-		12½	25	6 5 0	2/3	1/3	2/3	1/4½
150,000	2/-	Case (Alfred) & Co. Ltd.	5/-	—1½d.	25	25	10 0 0	5/3	4/7½	5/3	4/-
555,000	1	Clifford (Chas.) Ltd.	22/10½		10	10	8 15 0	22/10½	22/6	22/-	16/-
45,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 6	—	—	16/-	15/-
250,000	2/-	Coley Metals	3/4½	+4½d.	20	25	11 17 0	3/4½	2/10½	4/6	2/6
8,730,596	1	Cons. Zinc Corp.†	61/9		18¾	22½	6 3 0	67/6	60/6	65/3	41/-
1,509,528	1	Davy & United	93/6		20	15	4 5 6	96/-	86/-	87/-	45/9
2,915,000	5/-	Delta Metal	30/-	+9d.	31	30	5 3 3	30/-	24/1½	25/-	17/7½
4,600,000	Stk. (£1)	Enfield Rolling Mills Ltd.	46/6	—1/6	15	12½	6 9 0	48/-	36/7½	38/-	22/9
750,000	1	Evered & Co.	31/6	+9d.	10§	15Z	6 7 0	31/6	30/-	30/-	26/
18,000,000	Stk. (£1)	General Electric Co.	31/9	+3d.	10P	12½		40/3	30/9	40/6	29/6
1,500,000	Stk (10/-)	General Refractories Ltd	33/9	—1/3	20	20	5 18 6	40/-	33/9	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	64/-		15	15	4 13 6	66/6	64/-	67/6	61/-
750,000	5/-	Glacier Metal Co. Ltd.	6/9		11½	11½	8 10 3	7/1½	6/7½	8/3	5/-
1,750,000	5/-	Glynwed Tubes	17/6	—9d.	20	20	5 14 3	19/3	16/4½	18/1½	12/10½
5,421,049	10/-	Goodlass Wall & Lead Industries ...	30/9	—3d.	13‖	18Z	4 4 6	31/6	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	79/6		20	17½	5 0 6	83/9	75/-	57/9	45/-
396,000	5/-	Harrison (B'ham) Ord.	16/3	+1/3	*15	*15	4 12 3	16/3	14/11½	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6		7	7	7 3 6	—	—	19/9	18/4½
1,075,167	5/-	Heenan Group	8/-		10	10‡	6 5 0	8/3	7/6	9/7½	6/9
236,958,260	Stk. (£1)	Imperial Chemical Industries ...	34/3	—7½d.	12Z	10	4 13 3	38/3	33/9	38/-	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	16/6		5	5	6 1 3	16/10½	16/-	17/1½	16/-
14,584,025	••	International Nickel	165	—3½	$2.82	$3.75	2 15 3	171	153	169	132¾
860,000	5/-	Jenks (E. P.), Ltd.	9/3		14	27½♦	7 11 3	10/-	8/9	10/-	6/7½
330,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3		5	5	6 3 0	16/3	15/4½	16/9	15/-
3,937,435	1	Ditto Ord.	48/6	—3d.	10	10	4 2 6	52/6	44/3	47/-	36/6
600,000	10/-	Keith, Blackman	27/6		17½E	15	6 7 3	27/6	25/-	28/9	15/-
320,000	4/-	London Aluminium	6/3		10	10	6 8 0	6/4½	5/3	6/-	3/-
765,012	1	McKechnie Brothers Ord.	42/6		15	15	7 1 3	45/-	42/6	45/-	32/-
1,530,024	1	Ditto A Ord.	40/-		15	15	7 10 0	43/6	40/-	45/-	30/-
1,108,269	5/-	Manganese Bronze & Brass	15/6		20	27½‡	6 9 0	15/6	13/9	14/1½	8/9
50,628	6/-	Ditto (7½% N.C. Pref.)	6/-		7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	78/-		11	11	2 16 6	79/-	66/6	73/3	40/6
415,760	Stk. (2/-)	Metal Traders	9/9	+3d.	50	50	10 5 3	9/9	8/4½	9/-	6/3
160,000	1	Mint (The) Birmingham	22/9		10	10	8 15 9	22/9	22/-	22/9	19/-
80,000	5	Ditto Pref. 6%	72/6		6	6	8 5 6	75/6	69/-	83/6	69/-
3,705,670	Stk. (£1)	Morgan Crucible A	45/6	+1/-	10	10	4 8 0	45/9	43/6	45/-	34/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/6		5½	5½	6 5 9	18/6	17/6	18/-	17/-
2,200,000	Stk. (£1)	Murex	46/-	—2/-	17½	20	7 12 0	49/6	42/-	58/9	46/-
468,000	5/-	Ratcliffs (Great Bridge)	10/7½	+3d.	10R	10	4 14 0	11/3	10/4½	11/1½	6/10½
234 960	10/-	Sanderson Bros. & Newbould ...	28/9		20	27½D	6 19 3	28/9	27/9	27/3	24/6
1,365,000	Stk. (5/-)	Serck	19/6	+6d.	15	17½	3 17 0	19/6	18/-	18/7½	11/-
6,698,586	Stk. (£1)	Stone-Platt Industries	44/6		15	12½	6 14 9	46/9	43/3	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	16/1½		5½	5½	6 16 6	16/7½	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	81/9	—1/3	17½	15	4 8 6	83/3	72/-	86/-	48/4½
41,000,000	Stk. (£1)	Vickers	31/7½	—3d.	10	10	6 6 6	37/-	30/6	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	14/9		5	5	6 15 6	15/0¾	14/7½	15/9	14/3
6,863,837	Stk. (£1)	Ditto Pref. 5% tax free	21/6		*5	*5	7 3 6A	22/7½	21/7½	23/-	21/3
2,200,000	1	Ward (Thos. W.), Ord.	83/6	—6d.	20	15	4 15 9	87/6	83/6	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	42/6	—6d.	10	10	4 14 0	47/-	39/9	46/6	32/6
225,000	2/-	Wolverhampton Die-Casting ...	10/6	+3d.	30	25	5 14 3	10/6	8/8½	10/1½	7/-
591,000	5/-	Wolverhampton Metal	22/9		27½	27½	6 0 9	23/-	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell	6/6	—1½d.	20	20	7 13 9	6/7½	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/7½		6	6	8 16 3	13/7½	13/6	13/-	11/3
150,000	1/-	Zinc Alloy Rust Proof	3/-		27	40D	9 0 0	3/-	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting **Shares of no Par Value. ‡ and 100% Capitalized Issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ♦ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. P Interim dividend since reduced. § And Special distribution of 2½% free of tax. R And proposed 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units.

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